General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

Produced by the NASA Center for Aerospace Information (CASI)

NASA CR-144000

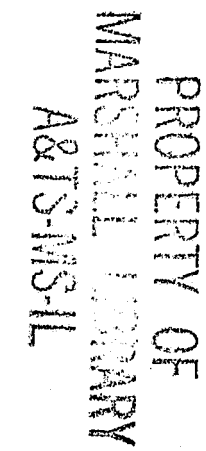
TRACK/TRAIN DYNAMICS
TEST REPORT
MODAL SURVEY

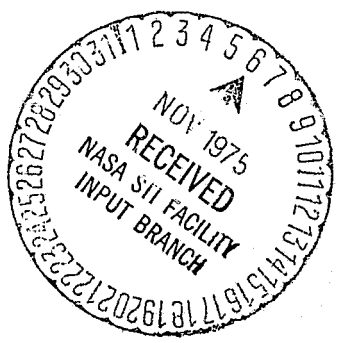
Contract NAS8-29882

(NASA-CR-144000) TRACK/TRAIN DYNAMICS TEST REPORT MODAL SURVEY (Martin Marietta Corp.) 314 p HC $9.25 CSCL 20K

N76-10476

Unclas
G3/37 03942





MARTIN MARIETTA

TR-002-MS
31 January 1975

TRACK/TRAIN DYNAMICS
TEST REPORT
MODAL SURVEY

Contract NAS8-29882

Prepared by:

R. A. Vigil
Staff Engineer
Space Systems Dynamics

Approved by:

G. Morosow
Program Manager
Track/Train Dynamics

P. W. Abbott
Technical Director
Track/Train Dynamics

MARTIN MARIETTA CORPORATION
Denver Division
Denver, Colorado 80201

FOREWORD

This document is submitted in accordance with the requirements for Technical Reports as specified by NASA Contract NAS8-29882.

CONTENTS

	Page
Title Page	i
Foreword	ii
Contents	iii
1.0 SCOPE	1
1.1 Purpose	1
1.2 Summary	1
2.0 APPLICABLE DOCUMENTS	1
3.0 MODAL SURVEY TEST DESCRIPTION	2
3.1 Test Objectives	2
3.2 Specimen/Test Configurations	2
3.3 Facilities Description	2
3.3.1 Test Configuration 1	2
3.3.2 Test Configuration 2	2
3.3.3 Test Configuration 3	2
3.3.4 Control System	2,3
3.3.5 Data Acquisition/Reduction System	3
3.4 Test Summary	3
3.4.1 Test Procedure	3
3.4.2 Instrumentation Summary	3
3.4.3 Data Summary	3
3.4.4 Detailed Test Description	3
3.4.4.1 Instrumentation Frequency Evaluation	3
3.4.4.2 Shaker Force Evaluation	4
3.4.4.3 Force Multiplier Evaluation	4
3.4.4.4 Modal Survey Test Descriptions	4
3.4.4.5 Roll Stop Evaluation	4
4.0 SUMMARY OF RESULTS	4
5.0 ABBREVIATIONS AND ACRONYMS	4,5

Figures

1	Test Configuration 1 - Car Empty	6
2	Test Configuration 2 - Car Full	7
3	Test Configuration 3 - System Test	8
4	Freight Car Loaded With Coal	9
5	Amplitude and Phase Control Console	10
6	Shaker Power Amplifiers	11
7	Time Data Digital Computer	12
8	Oscillograph Recorder	13

CONTENTS (continued)

Tables

I Track/Train Modal Survey Test Summary - Configuration 1, Car Empty 14,15

II Track/Train Modal Survey Test Summary - Configuration 2, Car Full 16,17

III Track/Train Modal Survey Test Summary - Configuration 3, System Test 18,19,20

IV Mode Frequency/Damping Summary 21

Appendices

A Configuration 1, Car Empty, Test Data A1-A72

B Configuration 2, Car Full, Test Data B1-B102

C Configuration 3, System Test, Test Data C1-C148

D Modal Survey Test Requirements Document, Post-Test Update D1-D12

E Modal Survey Test Procedure, Post-Test Update E1-E59

1.0 SCOPE

1.1 Purpose - This report presents a description of the modal survey vibration test conducted on an 80 ton open hopper freight car. It also presents the test data and a post-test update of the modal survey test requirements document and procedure. Included in the text is a description of the test objective, test specimen configuration, test facilities, test methods, data acquisition/reduction operations, and a chronological test summary.

1.2 Summary - The modal survey vibration test was conducted during the period extending from 17 October through 3 December 1974 at the Martin Marietta Corporation Structures Test Facility in Denver, Colorado.

An index to the data for the three test configurations is presented in Tables I, II and III. These tables also summarize the test sequence. The data are presented in Appendix A, B and C and are arranged by increasing modal frequencies. Appendix D and E contain a copy of the post-test update of the modal survey test requirements document and test procedure. The test procedure contains photographs of actual measurement locations and the test historical log.

The test data is currently being used for the refinement and verification of the freight car linear elastic model.

2.0 APPLICABLE DOCUMENTS

The following documents of exact issue shown, form a part of this document to the extent specified herein. This document shall govern where differences occur in presented material.

P74-48338-1, "Track-Train Dynamics Analysis and Test Program"

TS-002-MS, "Track/Train Dynamics, Test Requirements Document, Modal Survey," dated 31 January 1975

TP-002-MS, "Track/Train Dynamics, Test Procedure, Modal Survey," dated 31 January 1975

LAB 1007302, "Track-Dynamic Analysis GVS and Transfer Function Test," Test Fixture Drawings

DSW247, Barry Controls Air Serva-Level Operations Manual

1923-01000, Time Data Operations Manual

3.0 MODAL SURVEY TEST DESCRIPTION

3.1 Test Objective - The objective of the freight car modal survey test was to obtain modal test data for the refinement and verification of the freight car linear elastic analytical model.

3.2 Specimen/Test Configuration - The test specimen consisted of an L&N RR model M-042-174 80 ton open hopper freight car with ASF-11 trucks. Details concerning the test article general arrangement can be found in Appendix D, Figure 1. The first test configuration was the empty freight car supported on a height sensing air suspension system which was located at each corner of the car. Shakers were directly coupled to the freight car through stinger assemblies. The second test configuration was the full car loaded with approximately 162,000 lbs of coal. Shakers were coupled to the freight car through force multiplier assemblies at each of the four corners of the car. The third test configuration (system test) was the full car supported by the ASF-11 trucks. The wheel sets were positioned on steel plates with wheel chocks. Pins were used to disengage the friction shoe assemblies in each truck. These test configurations are depicted in Figures 1 through 4.

3.3 Facilities Description - The tests described in this document were conducted at the Martin Marietta Corporation Structures Laboratory located in Denver, Colorado. All the test equipment was in current calibration during testing.

3.3.1 Test Configuration 1 - The test specimen was supported at four points by a Berry Controls air serva-level system which automatically compensates for changes from the static position. This compensation is compatable with small amplitude shaker motion. Approximately 30 psi of air was required to raise the freight car 0.25 inches. Six 150 force pound Unholtz-Dickie shakers were used to vibrate the test specimen.

3.3.2 Test Configuration 2 - The freight car was filled with coal by a conveyor belt system. Approximately 100 psi of dry nitrogen was required to raise the loaded freight car 0.25 inches. Force multiplier assemblies were used with the shakers at the four corners of the car. Details of the 10:1 force multiplier can be found in Appendix E, Figure 7.5.

3.3.3 Test Configuration 3 - ASF-11 trucks were used to support the freight car assembly during this series of tests. The freight car was positioned on the trucks one at a time with the use of two 50 ton hydraulic jacks.

3.3.4 Control System - A manual six channel control system was used for this test. Amplitude was individually selectable for each shaker system. Phase was individually selectable for each shaker system such that the shakers were either in phase or 180° out of phase. The

sinusoidal drive signal was optionally selectable from an analog sweep oscillator used for course tuning, or from the synthesizer used with the Time Data digital computer.

3.3.5 Data Acquisition/Reduction System - The data for each mode was acquired and CO/QUAD calculations were made as the test progressed. Decay data was recorded real time on an oscillograph recorder and also on magnetic tape for future data reduction. The CO/QUAD calculations were made and either plotted or tabulated by the Time Data 1923 digital computer. Experimental mode shape plots were obtained from the CDC computer. A block diagram of the shaker control, data acquisition and data reduction systems is presented in Appendix E, Figure 7.3. Photographs of these systems is also presented in Figures 5 through 8.

3.4 Test Summary - In order to accomplish the stated objective, the test was conducted in accordance with the requirements specified in the test requirements document (TS-002-MS, Appendix D). The chronological sequence of the tests, along with run numbers, test description, test reference documents, control measurements, and data reference is presented in Tables I through III. Test modifications were originated by the test control board and directed by the technical director.

3.4.1 Test Procedure - The performance of each vibration test, identified by run numbers in Tables I through III, was implemented by following the steps described in the test procedure (TP-002-MS, Appendix E). The historical log of daily activities forms a part of the test procedure.

3.4.2 Instrumentation Summary - A maximum of 56 measurements were recorded for a given mode. Information concerning measurement effectivity is represented by the CO/QUAD tabulations of each mode in Appendices A through C. Instrumentation locations are identified in Figure 7.2, Appendix E. Photographs of measurement locations are also presented in Appendix E, Figures 7.2a through 7.2h.

3.4.3 Data Summary - All the test data for test configurations 1 through 3 are presented in Appendices A, B and C, respectively. Quick look decay data, computer printout and magnetic tapes generated during this test are available and are being maintained in data retention files.

3.4.4 Detailed Test Description - The following test descriptions provide information concerning the performance of each major test sequence.

3.4.4.1 Instrumentation Frequency Evaluation - A pretest evaluation of the instrumentation used for this test was conducted to determine frequency and phase response. The accelerometers were evaluated on a micro-gee air bearing vibration system from 0.5 Hz to 50 Hz. All the accelerometers used (see Table 8.2, Appendix E) had good response characteristics between 2 Hz and 50 Hz. In addition, the strain gauge accelerometers, the U-D 75 D/21, and the Columbia 302-2 accelerometers had good response characteristics down to 0.5 Hz.

3.4.4.2 Shaker Force Evaluation - A pre-test shaker system force evaluation was conducted to determine the maximum continuous force capability of the U-D shaker system. The shaker armature was mechanically grounded and tests were conducted between 0.5 Hz to 50 Hz. Based on maximum allowable armature current the shaker system was capable of delivering in excess of 125 lb-pk continuously.

3.4.4.3 Force Multiplier Evaluation - A pre-test evaluation of the force multiplier system was conducted to determine feasibility of application. Based on the wide band sweep data acquired and waveform observations, it was determined that the force multiplier was adequate for use below 25 Hz and 60 lbs-pk force input.

3.4.4.4 Modal Survey Test Description - All modes for each of the three subject test configurations were tuned using the same basic procedure. Wide band sweep data, narrow band sweep data, decay data, lissajous figures and waveform data were reviewed prior to fine tuning each mode. Fine tuning was accomplished by peaking the quadrature (imaginary) component of the acceleration to input force ratio. The parameters which were varied in order to isolate the different modes were shaker location, shaker phasing and force distribution. Once each mode was tuned, CO/QUAD data was tabulated for each measurement and final decays were recorded on magnetic tape.

3.4.4.5 Roll Stop Evaluation - A series of wide band sweeps were conducted to evaluate the effect of having the freight car body mechanically grounded at the roll stops. Three conditions were evaluated. First, the car was placed on 0.5 inch steel plates located between the car and roll stops at 4 locations. This condition resulted in an unrealistic test case when the car shifted during pitch excitation and the bolster assembly made contact with the side frame friction shoes. Second, the steel plates were removed and wooden wedges were used between the car and the roll stop pads at 4 locations. Third, the wedges were removed along one side of the car which simulated a roll condition. A comparison of the data for conditions 2 and 3 with data from the configuration 3 tests revealed no noticable difference.

4.0 SUMMARY OF RESULTS

The modal survey test of the 80 ton open hopper freight car was successfully completed in accordance with the requirements specified in Appendix D. Included in the test data (Appendices A, B and C) for each mode are the mode shape data, shaker force and phase distribution data, damping data and mode shape plots. A summary of the modal frequencies, mode descriptions and the damping data is included in Table IV. The detailed comparison of the data contained herein with the analytical results will be presented in a subsequent report.

5.0 ABBREVIATIONS AND ACRONYMS

Calib. Calibration

Cap.	Capacity
CDC	Control Data Corporation
Ch.	Channel
Ck.	Check
CO	Coincidence Component
ET	Electronic Technician
FS	Full Scale
GVS	Ground Vibration Survey
Meas.	Measurement
Mfg.	Manufacturer
MMC	Martin Marietta Corporation
MSFC	Marshall Space Flight Center
MT	Mechanical Technician
NASA	National Aeronautics and Space Administration
No.	Number
O-Graph	Oscillograph
Osc.	Oscillator
Qty.	Quantity
QUAD	Quadrature Component
Sens.	Sensitivity
SF	Safety
SW	Switch
TCB	Test Control Board
TD	Technical Director
TE	Test Engineer
TTY	Teletype Terminal
Typ.	Typical
U-D	Unholtz-Dickie Corporation
XDCR	Transducer

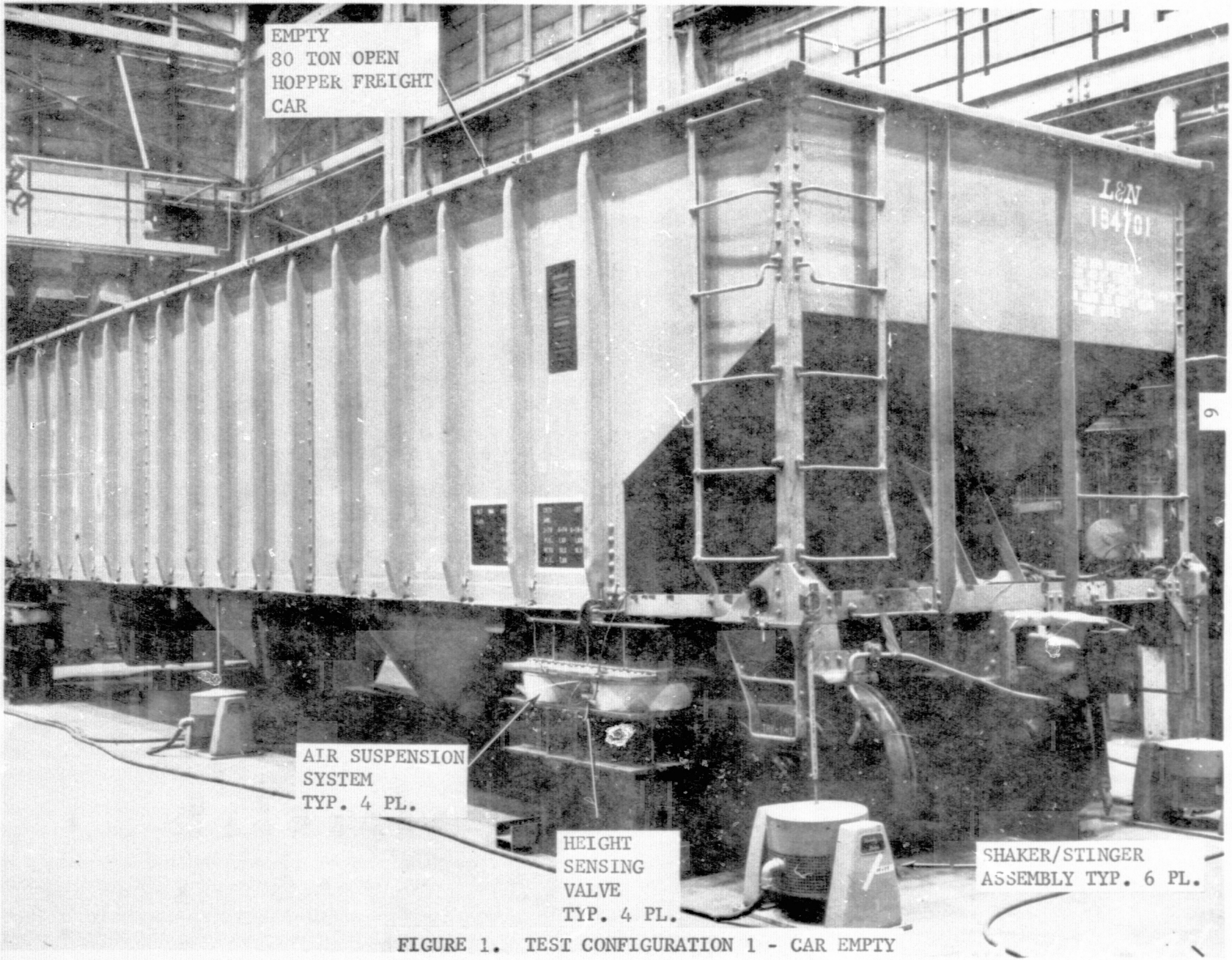


FIGURE 1. TEST CONFIGURATION 1 - CAR EMPTY

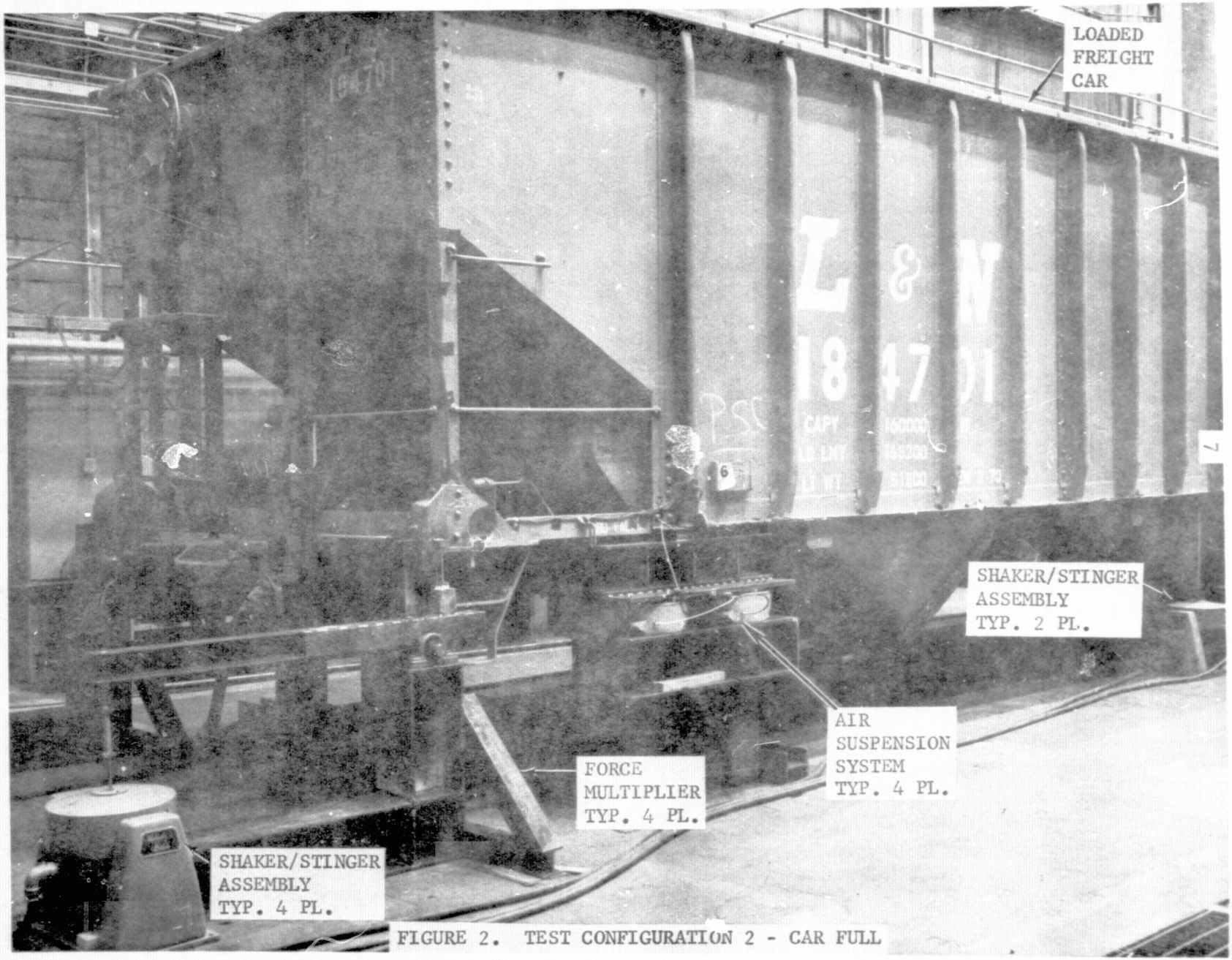


FIGURE 2. TEST CONFIGURATION 2 - CAR FULL

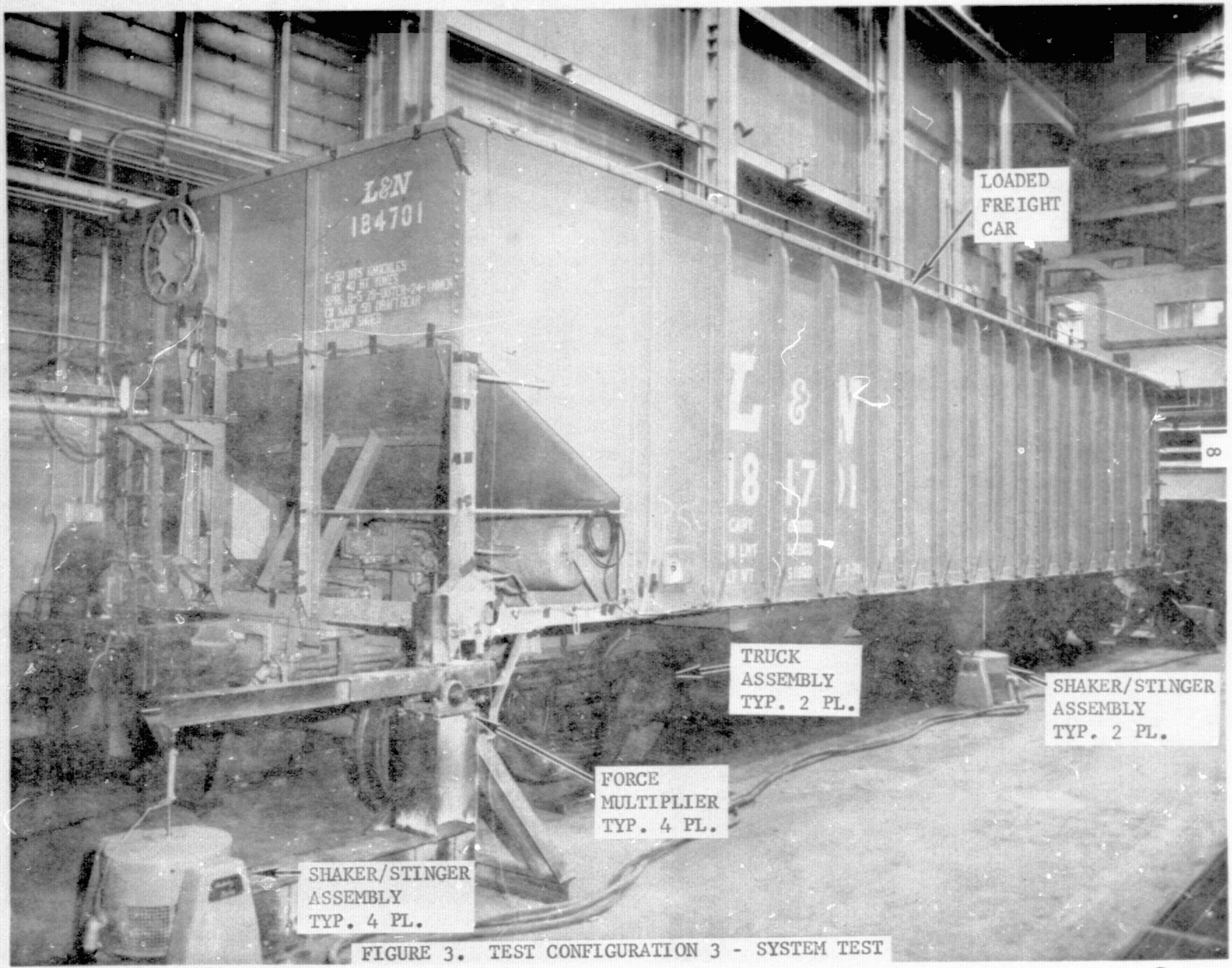


FIGURE 3. TEST CONFIGURATION 3 - SYSTEM TEST

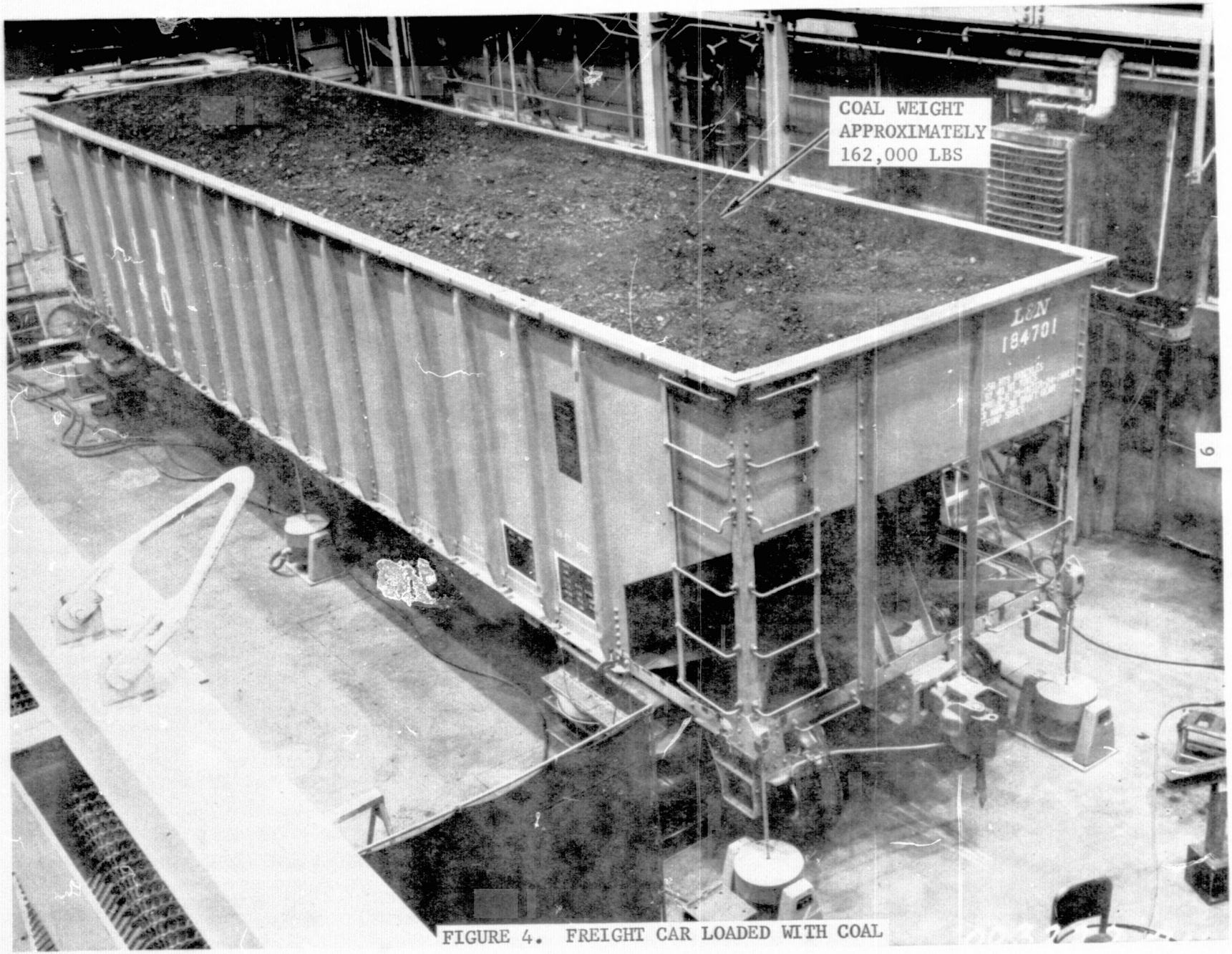


FIGURE 4. FREIGHT CAR LOADED WITH COAL

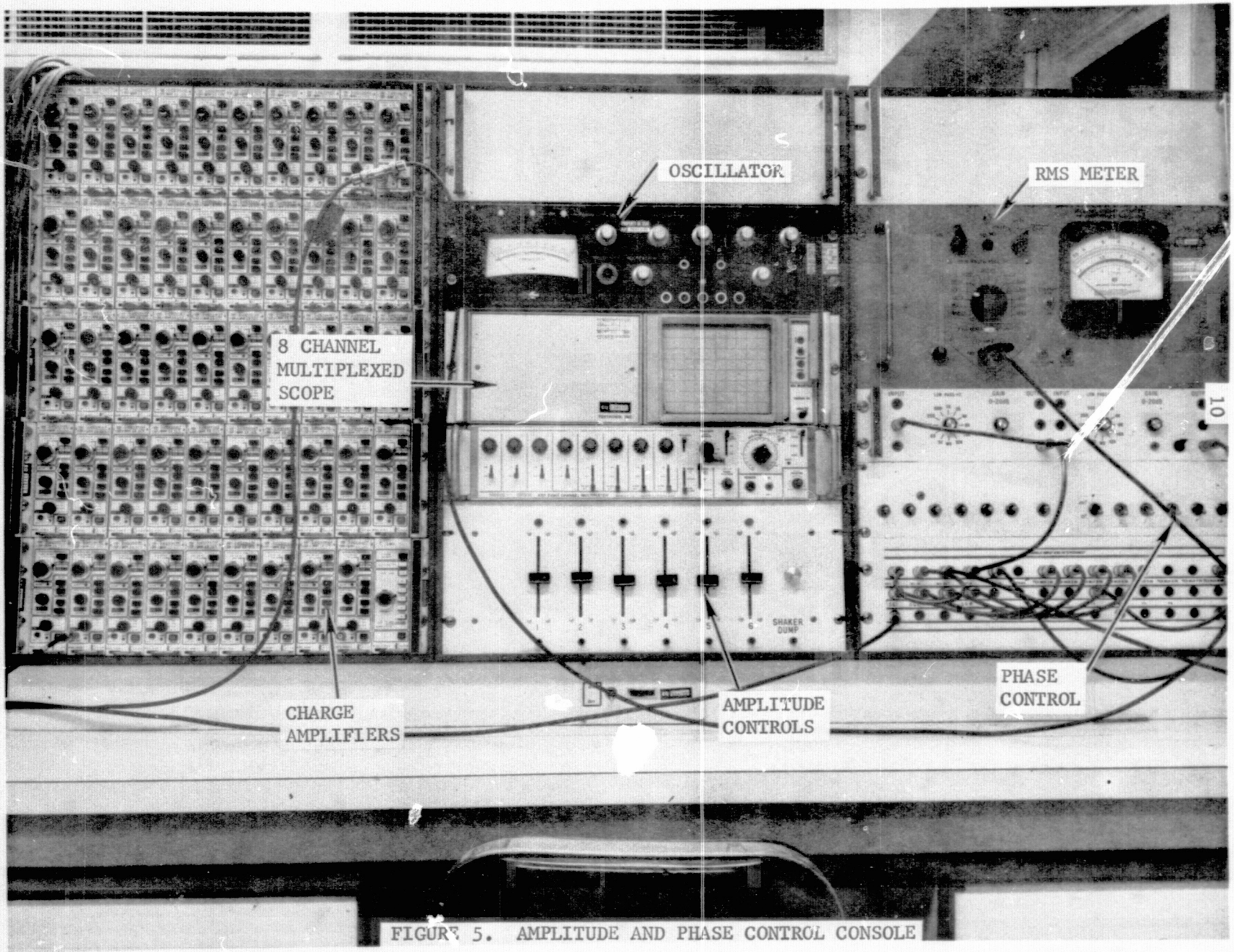


FIGURE 5. AMPLITUDE AND PHASE CONTROL CONSOLE

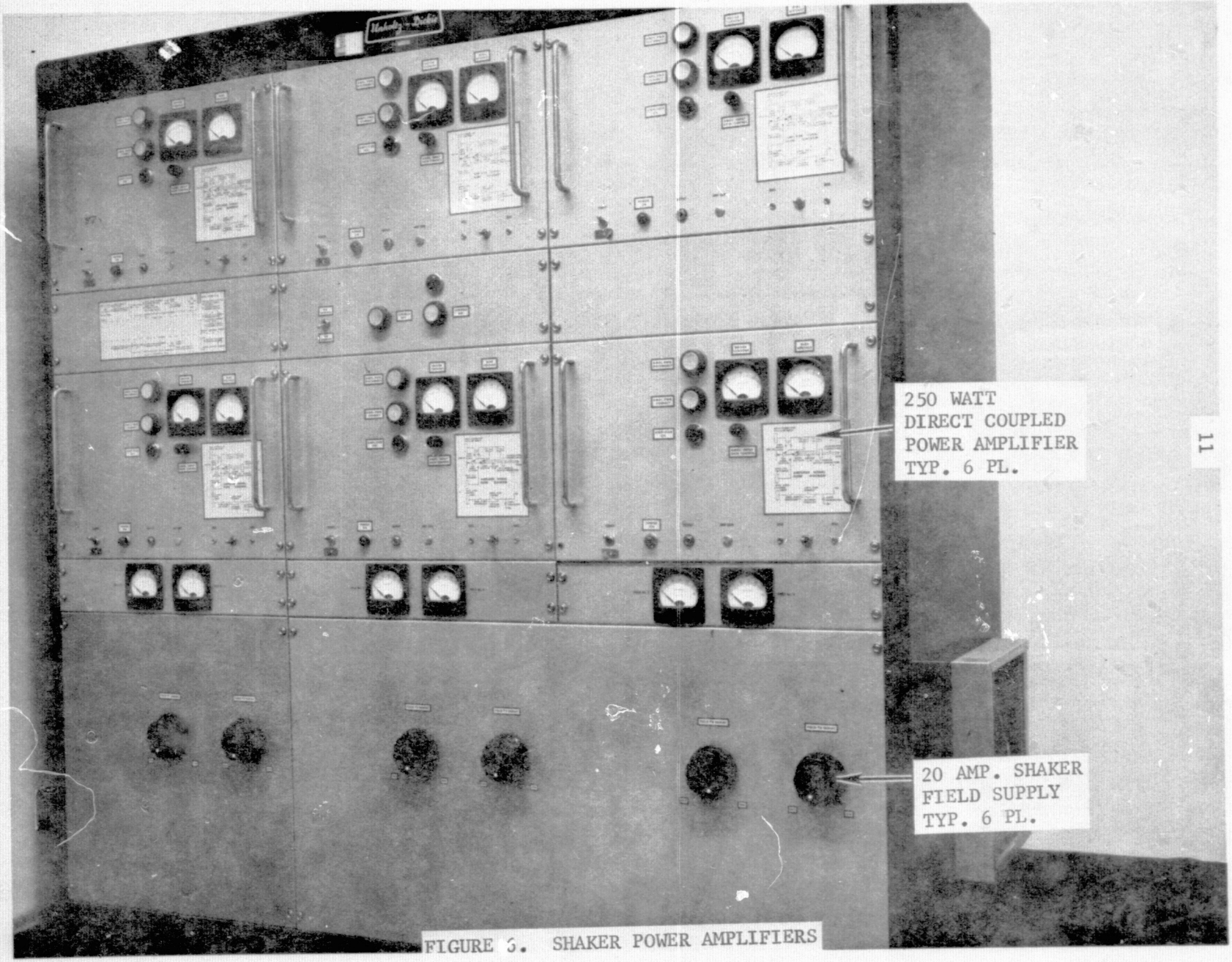


FIGURE 3. SHAKER POWER AMPLIFIERS

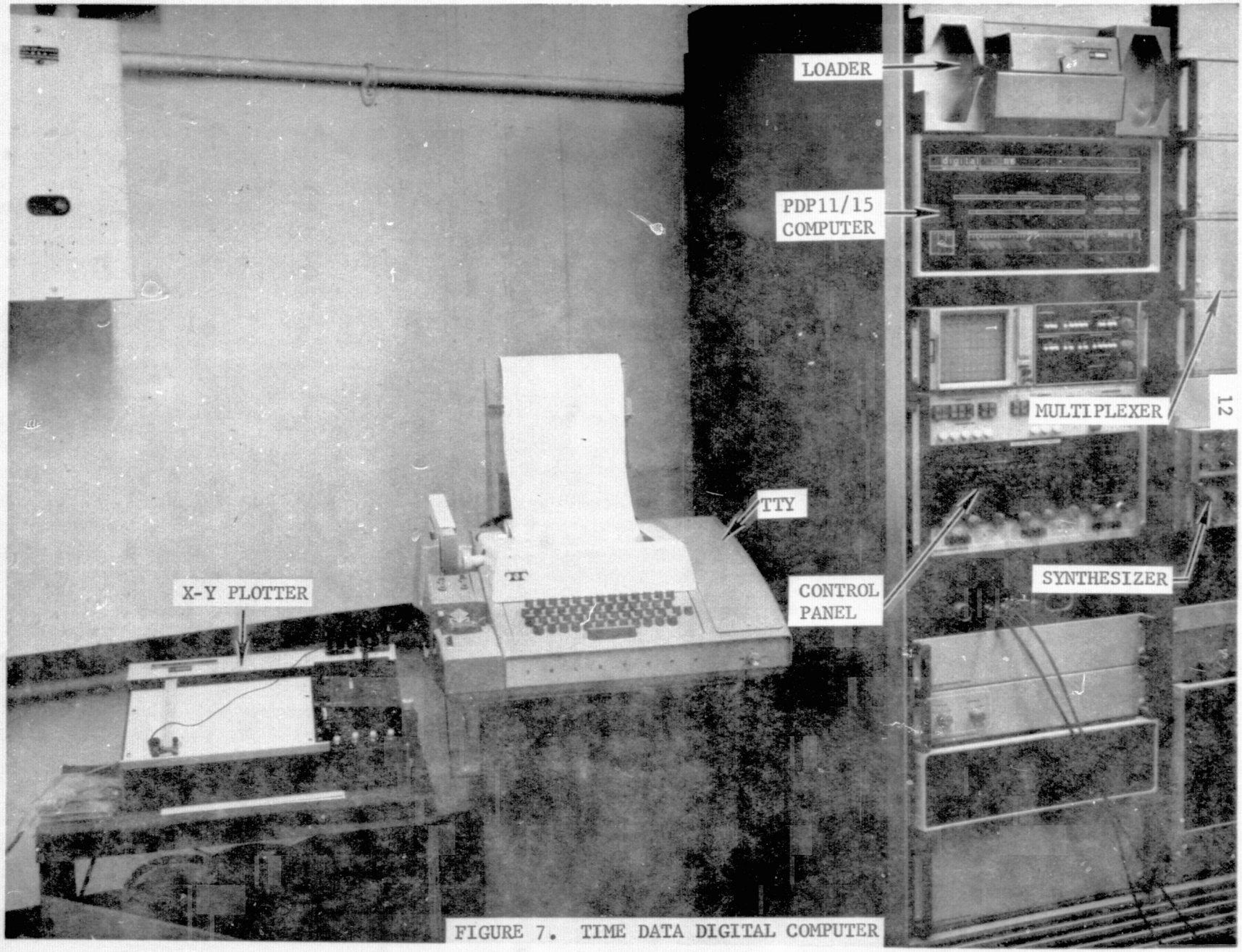


FIGURE 7. TIME DATA DIGITAL COMPUTER

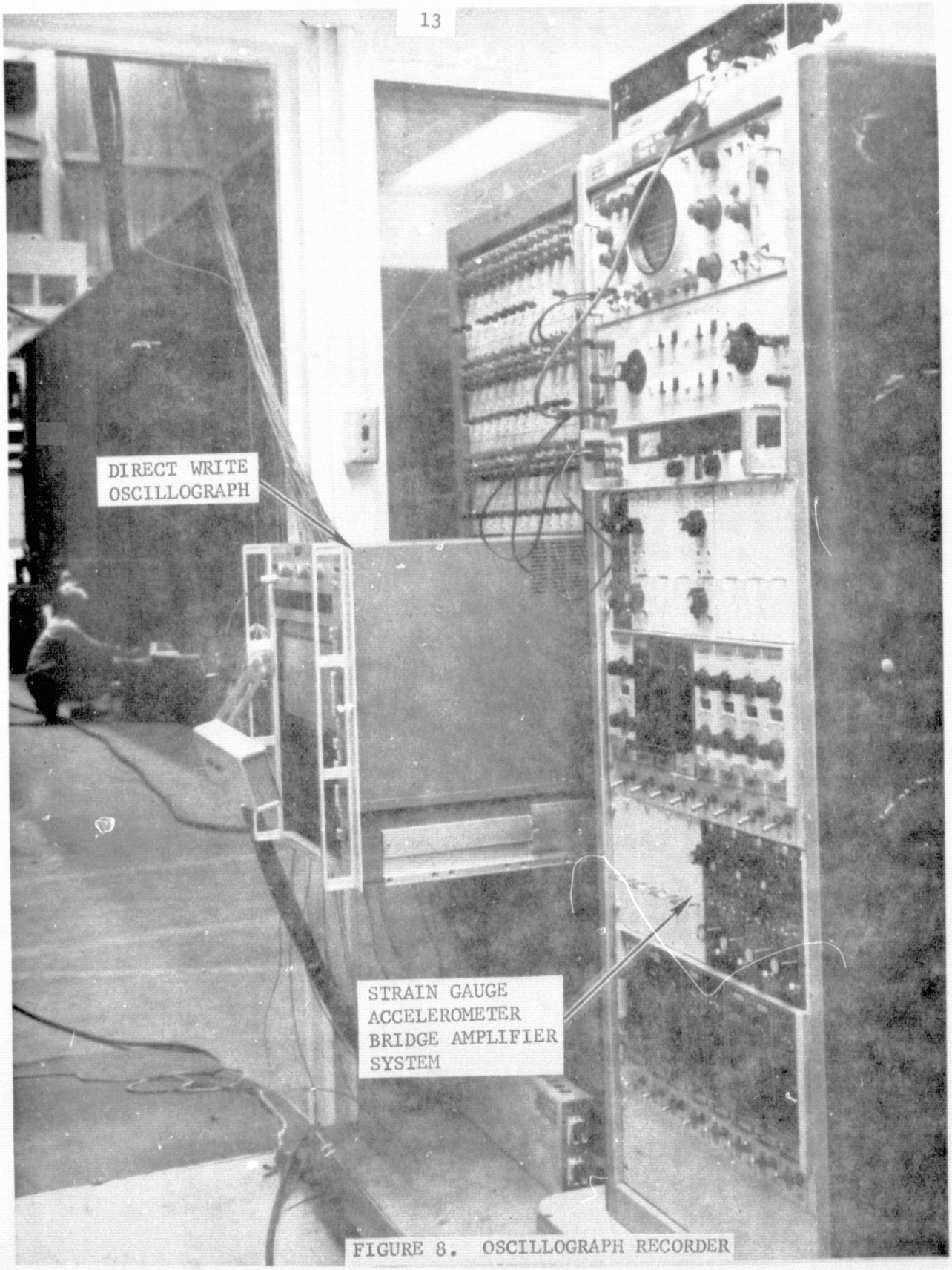


FIGURE 8. OSCILLOGRAPH RECORDER

TABLE I TRACK/TRAIN MODAL SURVEY TEST SUMMARY- CONFIGURATION 1, CAR EMPTY

TEST SEQUENCE	RUN NO.	TEST DESCRIPTION	TEST REFERENCE	RECORDED MEASUREMENTS	TEST FREQUENCY (HZ)	TEST DATE	DATA REFERENCE	REMARKS
1) Force Multiplier Evaluation	1) 1 WB through 5 WB	1) Wide Band Sinewave Sweep	1) Per TD	1) AV17,AV18,AV20, AV21,AV24,F3	1) 0.5 to 50	1) 10/17/74 & 10/18/74	1) Data Included In Appendix A,Pages	1) Force Applied W/Multiplier; F3=20 lb-pk @ 10 Hz; Force Multiplier Gain = 5.
2)	2) 6 WB through 12 WB	2)	2)	2) AV17,AV20,AV21,F3	2)	2) 10/18/74	2) A2-A25	2) Force Applied W/O Multiplier; F3= 100 lb-pk @ 10 Hz; F3=150 lb-pk @ 20 Hz for Run 12 WB.
3)	3) 13 WB through 16 WB	3)	3)	3) AV17,AV24,AV18, AL1,F3	3)	3) 10/21/74	3)	3) Force Applied W/Multiplier; F3=20 lb-pk @ 10 Hz; AL18 & AL1 Were Located on the Multiplier Beam With AL18 Opposite F3 and AL1 Opposite AV17.
4) 6.75 Hz Mode	4) INB	4) Narrow Band Sinewave Sweep	4) Reqmts. Document TS-002-MS , Test Procedure TP-002-MS	4) AV17, F3	4) 0.5 to 10	4)	4) Data Included In Appendix A Pages A39-A47	4) Force Applied With 4 Shakers; Ref. Force F3=39.6 lb-pk @ 10 Hz; V1, V5 = 180° Ø, V3, V7 = 0° Ø.
5)	5) Decay 1	5) Sinewave Dwell & Decay	5)	5) AV1,AV8,AV17,AV24	5) 6.35	5)	5) Quick Look Data Not Included	5) Slight Waveform Distortion.
6)	6) Dwell 1	6) Sinewave Dwell	6)	6) AV17, F3	6) 6.75	6)	6)	6) Force Applied With 4 Shakers; Ref. Force F3=79.2 lb-pk; Found Gain Error on AV1,AV8,AV17 & AV24. V1,V5- 180°Ø, V3,V7,- 0°Ø
7)	7) Dwell 1	7)	7)	7)	7)	7) 10/22/74	7)	7) Repeated Item 6; Found Additional Instrumentation Errors.
8)	8) Dwell 1	6)	8)	8) AV1-AV24,AL1-AL18, F1,F3,F5,F7	8)	8) 10/23/74	8) Data Included In Appendix A	8) Repeated Item 6.
9)	9) Decay 2	9) Sinewave Dwell & Decay	9)	9) AV1,AV8,AV17,AV24, F3,OSC.	9)	9)	9)	9) Force & Phase In Accordance With Item 6.
10) 3.45 Hz Mode	10) 2 NB through 5 NB	10) Narrow Band Sinewave Sweep	10)	10) AV1,AV8,AV17,AV24, F3	10) 0.5 to 5	10) 10/23/74	10) Pages A26-A38	10) Force Applied With 4 Shakers; Ref. Force F3=79.2 lb-pk @ 5 Hz; V1, V7 = 0° Ø, V3, V5 = 180° Ø.
11)	11) Dwell 2	11) Sinewave Dwell	11)	11) AV1,AV8,AV17,AV24, F1,F3,F5,F7	11) 3.45	11)	11)	11) Force Applied With 4 Shakers; Ref. Force F1=63.65 lb-pk; V1, V7 = 0° Ø, V3, V5 = 180° Ø.
12) 29.57 Hz Mode	12) 17 WB through 26 WB	12) Wide Band Sinewave Sweep	12)	12) AV12,AV9,AV16, AL12, F4	12) 10 to 50	12) 10/23/74 10/24/74	12) Pages A56-A72	12) Force Applied With 5 Shakers; Ref. Force F4=79.2 lb-pk @ 20 Hz & Other Forces = 19.9 lb-pk; V1, V3, V5, V7 = 0° Ø, V4 = 180° Ø.
13)	13) Dwell 3	13) Sinewave Dwell	13)	13) AV12, F4	13) 29.65	13) 10/24/74	13) Quick Look Data Not Included	13) Force Applied With 5 Shakers; Ref. Force F4=79.2 lb-pk; V1, V3, V5, V7 = 0° Ø, V4 = 180° Ø.
14)	14) Decay 3	14) Sinewave Dwell & Decay	14)	14) AV9,AV12,AV13, AV16	14) 29.65,29.53, 29.57	14)	14)	14) Minimum Beating @ 29.57 Hz.
15)	15) Dwell 3	15) Sinewave Dwell	15)	15) AV1-AV24,AL1-AL18, F1,F3,F4,F5,F7	15) 29.57	15)	15) Data Included In Appendix A	15) Force and Phase Parameters Same as Item 13.

TABLE I TRACK/TRAIN MODAL SURVEY TEST SUMMARY- CONFIGURATION 1, CAR EMPTY (CONTINUED)

TEST SEQUENCE	RUN NO.	TEST DESCRIPTION	TEST REFERENCE	RECORDED MEASUREMENTS	TEST FREQUENCY (HZ)	TEST DATE	DATA REFERENCE	REMARKS
16) 29.57 Hz Mode	16) Decay 4	16) Sinewave Dwell & Decay	16) Reqmts. Document TS-002-MS , Test Procedure TP-002-MS	16) AV9,AV12,AV13, AV16,F4,OSC.	16) 29.57	16) 10/24/74	16) Data Included In Appendix A Pages A56-A72	16) Force and Phase Parameters Same as Item 13.
17) 17.64 Hz Mode	17) 27 WB	17) Wide Band Sinewave Sweep	17)	17) AV1, F8	17) 10 to 50	17)	17) Pages A48-A55	17) Force Applied With 6 Shakers; Ref. Force F8=F9=39.9 lb-pk @ 10 Hz & Other Forces = 19.9 lb-pk; V1, V7, V9 = 0° Ø, V3, V5, V8 = 180° Ø
18)	18) Decay 5	18) Sinewave Dwell & Decay	18)	18) AV1,AV8,AV17,AV24, AL12	18) 17.6	18)	18) Quick Look Data Not Included	18) No Apparent Beating.
19)	19) Dwell 4	19) Sinewave Dwell	19)	19) AV1-AV24,AL1-AL18, F1,F3,F5,F7,F8,F9	19) 17.64	19)	19) Data Included In Appendix A	19) Force Applied With 6 Shakers, Ref. Force F8=39.6 lb-pk, V1, V7, V9 = 0° Ø, V3, V5, V8 = 180 ° Ø.
20)	20) Decay 6	20) Sinewave Dwell & Decay	20)	20) AV1,AV8,AV17,AV24, AL12,F8,OSC.	20)	20)	20)	20)

NOTE: ITEMS 2&4 (6.75 HZ MODE) THROUGH 20 WERE ACCOMPLISHED USING THE SHAKERS DIRECTLY COUPLED TO THE TEST SPECIMEN.

TABLE II. TRACK/TRAIN MODAL SURVEY TEST SUMMARY - CONFIGURATION 2, CAR FULL

TEST SEQUENCE	RUN NO.	TEST DESCRIPTION	TEST REFERENCE	RECORDED MEASUREMENTS	TEST FREQUENCY (HZ)	TEST DATE	DATA REFERENCE	REMARKS
1) 6.3 Hz Mode	1) 6NB	1) Narrow Band Sinewave Sweep	1) Reqmts. Document TS-002-MS , Test Procedure TP-002-MS	1) AV17,F3	1) 0.5 to 15	1) 11/4/74	1) Data Included In Appendix B, Pages B20-B40	1) Force Applied With 4 Shakers; Ref. Force F3 And Others = 100 lb-pk @ 10 Hz; V1, V5=0°ϕ , V3, V7 = 180°ϕ ; Shakers Coupled Directly To Test Specimen.
2)	2) Dwell 1	2) Sinewave Dwell	2)	2) AV1-AV24,AL1-AL18, F1,F3,F5,F7	2) 6.75	2)	2)	2)
3)	3) 28WB through 30WB	3) Wide Band Sinewave Sweep	3)	3) AV1,AV12,F8	3) 5 To 50	3)	3)	3) Forces Applied With 6 Shakers; Ref. Force F8 and Others = 100 lb-pk @ 10 Hz; V1, V7, V9 = 0°ϕ , V3, V5, V8 = 180°ϕ For 28&29 WB; V1,V3,V5,V7= 0°ϕ , V8, V9 = 180°ϕ For 30 WB; Shakers Coupled Directly To Test Specimen.
4)	4) 7NB	4) Narrow Band Sinewave Sweep	4)	4) AV17, F3	4) 2 To 10	4) 11/7/74	4)	4) Forces Applied Coupled Through Multipliers With 4 Shakers; Ref. Force F3 And Others = 28.3 lb-pk @ 10 Hz; V1, V5 = 0°ϕ , V3, V7 = 180°ϕ .
5)	5) Dwell 1	5) Sinewave Dwell	5)	5) AV1-AV24,AL1-AL18, F1,F3,F5,F7	5) 6.3	5)	5)	5) Force Applied With 4 Shakers; Ref. Force F3 = 10.3 lb-pk; V1, V5 = 0°ϕ , V3, V7 = 180°ϕ .
6) 3.3 Hz Mode	6) 8 NB through 11 NB	6) Narrow Band Sinewave Sweep	6)	6) AV1, AV8, AV17, AV24, F3	6) 1 To 10	6)	6) Pages B13-B19	6) Forces Applied With 4 Shakers; Ref. Force F3 And Others = 28.3 lb-pk @ 10 Hz; V1, V7=0°ϕ , V3,V5 = 180°ϕ .
7)	7) Dwell 2	7) Sinewave Dwell	7)	7) AV1,AV8,AV17,AV24, F1,F3,F5,F7	7) 3.3	7)	7)	7) Ref. Force F3=15.6 lb-pk; V1,V7 = 0°ϕ , V3, V5 = 180°ϕ .
8) 8.85 Hz Mode	8) 12NB & 13NB	8) Narrow Band Sinewave Sweep	8)	8) AV1,AL1,F8	8) 5 To 20	8)	8) Pages B41-B49	8) Forces Applied With 6 Shakers; Ref. Force F8 And Others = 28.3 lb-pk @ 10 Hz; V1,V7,V9 = 0°ϕ , V3,V5, V8= 180°ϕ .
9)	9) Dwell 3	9) Sinewave Dwell	9)	9) AV1-AV24,AL1-AL18, F1,F3,F5,F7,F8,F9	9) 8.85	9) 11/8/74	9)	9) Force Ref. F8=29.7 lb-pk, V1,V7, V9 = 0°ϕ , V3,V5,V8 = 180°ϕ .
10)	10) Decay 7,8	10) Sinewave Dwell & Decay	10)	10) AL1,AV1,AV8,AV17, AV24,F8,OSC	10) 8.85	10)	10)	10)
11) Decays	11) Decay 9-12	11)	11)	11) AL1,AV1,AV8,AV17, AV24,F3 OSC.	11) 3.3, 6.3	11)	11)	11) Force Distribution And Phase In Accordance With Items 7 and 5 Respectively
12) 13.6 Hz Mode	12) 31WB	12) Wide Band Sinewave Sweep	12)	12) AV17,F3	12) 1 To 50	12)	12) Pages B65-B72	12) Force Applied With 4 Shakers; Ref. Force F3=28.3 lb-pk = F1 @ 10 Hz; V1,V7=0°ϕ,V3,V5=180°ϕ .
13)	13) Dwell 4	13) Sinewave Dwell	13)	13) AV1-AV24,AL1-AL18, F1,F3,F5,F7	13) 13.6	13)	13)	13) Force Ref F3=11.0 lb-pk; V1,V7 = 0°ϕ, V3,V5 = 180°ϕ.
14)	14) Decay 13, 14	14) Sinewave Dwell & Decay	14)	14) AL1,AV1,AV8,AV17, AV24,F3, OSC.	14) 13.6	14)	14)	14)
15) 2.15 Hz Mode	15) 32WB	15) Wide Band Sinewave Sweep	15)	15) AV12,F3	15) 1 To 50	15) 11/11/74	15) Pages B2-B12	15) Force Applied With 4 Shakers; Ref. Force F3 And Others = 28.3 lb-pk @ 10 Hz; V1,V3,V5,V7 = 0°ϕ .

TABLE II (Continued) TRACK/TRAIN MODAL SURVEY TEST SUMMARY-CONFIGURATION 2, CAR FULL

TEST SEQUENCE	RUN NO.	TEST DESCRIPTION	TEST REFERENCE	RECORDED MEASUREMENTS	TEST FREQUENCY (HZ)	TEST DATE	DATA REFERENCE	REMARKS
16) 2.15 Hz Mode	16) 14NB Through 18NB	16) Narrow Band Sinewave Sweep	16) Reqmts. Document TS-002-MS, Test Procedure TP-002-MS	16) AV17,AV1,AV8,AV24 AV12,F3	16) 0.5 To 5	16) 11/11/74	16) Data Included In Appendix B Pages	16) Force Ref. F3 And Others = 28.3 lb-pk @ 10 Hz; V1,V3,V5,V7 = 0° ϕ .
17)	17) Dwell 5	17) Sinewave Dwell	17)	17) AV1,AV8,AV12,AV17 AV24,F1,F3,F5,F7	17) 2.15	17)	17) B2-B12	17) Force Ref. F3 = 14.1 lb-pk; V1,V3, V5,V7 = 0° ϕ .
18) 11.9 & 12.3 Hz Mode	18) 19NB	18) Narrow Band Sine-wave Sweep	18)	18) AV12,F4	18) 5 To 20	18)	18) Pages B50-B64	18) Force Applied With 6 Shakers; Ref. Force F4 = 100 lb-pk = F4A, Others = 28.3 lb-pk @ 10 Hz; V,V3,V5,V7 = 0° ϕ , V4,V4A = 180° ϕ .
19)	19) Dwell 6	19) Sinewave Dwell	19)	19) AV1-AV24,AL1-AL18, F1,F3,F4,F4A,F5,F7	19) 11.9,12.3, 12.4	19)	19)	19) Force Ref F4 = 100 lb-pk for 11.9 Hz Mode & 49.5 lb-pk For 12.3 and 12.4 Hz Modes; V1,V3,V5,V7 = 0° ϕ V4,V4A = 180° .
20) 14.55 & 14.75 Hz Mode	20) Dwell 7	20)	20)	20)	20) 14.55,14.75	20) 11/12/74	20) Pages B73-B85	20) Force Ref. F4=100 lb-pk For 14.55 Hz Mode & 49.5 lb-pk For 14.75 Hz Mode; V1,V3,V5,V7 = 0° ϕ , V4,V4A = 180° ϕ .
21) 20.2 Hz Mode	21) 33WB	21) Wide Band Sinewave Sweep	21)	21) AV9, F3	21) 5 To 50	21)	21) Pages B93-B102	21) Force Applied With 4 Shakers; Ref. Force F3 And Others = 49.5 lb-pk @ 10Hz; V1,V3,V5,V7 = 0° ϕ .
22)	22) 34WB	22)	22)	22)	22)	22)	22)	22) Force Applied With 4 Shakers; Ref. Force F3 And Others = 62.2 lb-pk @ 10 Hz; V1,V3 = 0° ϕ , V5,V7 = 180° ϕ .
23)	23) Dwell 8	23) Sinewave Dwell	23)	23) AV1-AV24,AL1-AL18, F1,F3,F5,F7	23) 20.2	23)	23)	23) Force Ref. F3 = 9.5 lb-pk; V1,V3 = 0° ϕ , V5,V7 = 180° ϕ .
24) 17.1 Hz Mode	24) Dwell 9	24)	24)	24)	24) 17.1	24)	24) Pages B86-B92	24) Force Ref. F3=12.5 lb-pk; V1,V3 = 0° ϕ , V5,V7 = 180° ϕ .
25) Decays	25) Decay 15-28	25) Sinewave Dwell & Decay	25)	25) AV1,AV8,AV9,AV12, AV17, F3,F4,OSC.	25) 17.1,20.2, 2.15,14.75, 14.55,12.3,11.9	25)	25)	25) Force Distribution And Phase In-Accordance With Items 24, 23, 17, 20 & 19 Respectively.

NOTE: Force Multipliers With A Gain of 10 Were Used With Shakers V1, V3, V5 & V7 For Item 4 Through 25.

TABLE III TRACK/TRAIN MODAL SURVEY TEST SUMMARY - CONFIGURATION 3, SYSTEM TEST

TEST SEQUENCE	RUN NO.	TEST DESCRIPTION	TEST REFERENCE	RECORD MEASUREMENTS	TEST FREQUENCY (HZ)	TEST DATE	DATA REFERENCE	REMARKS
1) 6.31 HZ Mode	1) 35 WB through 38 WB	1) Wide Band Sinewave Sweep	1) Reqmts. Document TS-002-MS, Test Procedure TP-002-MS	1) AV9,AV12,F3	1) 2 to 50	1) 11/15/74	1) Data Included In Appendix C Pages C45-C51	1) Force applied with 4 shakers; Ref. force F3 and others = 28.3 lb-pk @ 10 Hz; V1,V3,V5,V7=0°ϕ for 35 & 38 WB; V1,V3=0°ϕ, V5,V7=180°ϕ for 36 & 37 WB; Truck Friction Shoes engaged.
2)	2) Dwell 1	2) Sinewave Dwell	2)	2) AV1-AV24,AL1-AL19, F1,F3,F5,F7	2) 6.31	2)	2)	2) Force ref. F3 = 19 lb-pk.
3) 2.126 Hz Mode	3) 39 WB through 41 WB	3) Wide Band Sinewave Sweep	3)	3) AV12,AV9,F3	3) 1 to 50	3) 11/21/74 11/22/74	3) Pages C2-C15	3) Force applied with 4 shakers; Ref. force F3 and others = 28.3 lb-pk @ 10 Hz; V1,V3,V5,V7=0°ϕ for 39 & 40 WB; V1,V3=0°ϕ, V5,V7=180°ϕ for 41 WB; truck friction shoes disengaged.
4)	4) Dwell 1	4) Sinewave Dwell	4)	4) AV1-AV32,AL1-AL18, F1,F3,F5,F7	4) 2.126	4) 11/22/74	4)	4) Force ref. F3 = 1.6 lb-pk; V1,V3, V5,V7 = 0°ϕ.
5) 2.85 Hz Mode	5) Dwell 2	5)	5)	5)	5) 2.85	5)	5) Pages C16-C22	5) Force ref. F3 = 1.4 lb-pk; V1,V3= 0°ϕ, V5,V7 = 180°ϕ.
6) 12.79 Hz Mode	6) Dwell 3	6)	6)	6) AV1-AV32,AL1-AL18, F1,F3,F4,F4A,F5,F7	6) 12.79	6)	6) Pages C66-C72	6) Force ref. F3 = 13.6 lb-pk; V1, V3,V5,V7 = 0°ϕ, V4,V4A = 180°ϕ.
7) 14.96 Hz Mode	7) Dwell 4	7)	7)	7) AV1-AV32,AL1-AL18, F1,F3,F4,F5,F7	7) 14.96	7)	7) Pages C87-C93	7) Force ref. F3 = 28.3 lb-pk; V1, V3,V5,V7 = 0°ϕ, V4 = 180°ϕ.
8) 17.9 Hz Mode	8) Dwell 5	8)	8)	8) AV1-AV32,AL1-AL18, F1,F3,F5,F7	8) 17.9	8) 11/25/74	8) Pages C101-C107	8) Force ref. F3 = 8.9 lb-pk; V1,V3= 0°ϕ, V5,V7 = 180°ϕ.
9) 19.5 Hz Mode	9) Dwell 6	9)	9)	9)	9) 19.5	9)	9) Pages C115-C121	9) Force ref. F3 = 8.9 lb-pk; V1,V3= 0°ϕ, V5,V7=180°ϕ.
10)	10) Decay 29,30	10) Sinewave Dwell & Decay	10)	10) AV1,AV8,AV9,AV12, AV17,AV24,F3,OSC.	10) 19.5	10)	10)	10)
11) Decays	11) Decay 31-40	11)	11)	11)	11) 17.9,14.96, 12.79,2.85, 2.126	11)	11)	11) Force distribution and Phase in accordance with Items 3 through 8, respectively.
12) 3.15 Hz Mode	12) 42 WB & 43 WB	12) Wide Band Sinewave Sweep	12)	12) AV17, F3	12) 0.5 to 50	12)	12) Pages C23-C31	12) Force applied with 4 shakers; ref. force F3 and others = 28.3 lb-pk @ 10 Hz; V1,V7=0°ϕ, V3,V5=180°ϕ for 42 WB; V1,V5=0°ϕ, V3,V7=180°ϕ for 43 WB.
13)	13) Dwell 7	13) Sinewave Dwell	13)	13) AV1-AV32,AL1-AL18, F1,F3,F5,F7	13) 3.15	13)	13)	13) Force ref. F3 = 8.5 lb-pk; V1, V7=0°ϕ, V3,V5=180°ϕ.
14)	14) Decay 41,42	14) Sinewave Dwell & Decay	14)	14) AV1,AV8,AV17,AV24, F3, OSC.	14) 3.15	14)	14)	14)
15) 6.3 Hz Mode	15) Dwell 8	15) Sinewave Dwell	15)	15) AV1-AV32,AL1-AL18, F1,F3,F5,F7	15) 6.16,6.3	15) 11/26/74	15) Pages C32-C44	15) Force ref. F3=3 lb-pk for 6.16 Hz mode and 13.6 lb-pk for 6.3 Hz mode; V1,V5=0°ϕ, V3,V7=180°ϕ; F3 distorted for 6.16 Hz mode

TABLE III (continued)

TEST SEQUENCE	RUN NO.	TEST DESCRIPTION	TEST REFERENCE	RECORD MEASUREMENTS	TEST FREQUENCY (HZ)	TEST DATE	DATA REFERENCE	REMARKS
16) 6.3 Hz Mode	16) Decay 43-46	16) Sinewave Dwell & Decay	16) Reqmts. Document TS-002-MS, Test Procedure TP-002-MS	16) AV1,AV8,AV17,AV24, AL1,F3,OSC.	16) 6.3, 6.16	16) 11/26/74	16) Pages C32-C44 Data Included In Appendix C	16) Force ref. F3=3 lb-pk for 6.16 Hz mode and 13.6 lb-pk for 6.3 Hz mode; V1,V5=0°Ø, V3,V7=180°Ø; F3 distorted for 6.16 Hz mode.
17) 14.48 Hz Mode	17) Dwell 9	17) Sinewave Dwell	17)	17) AV1-AV32,AL1-AL18, F1,F3,F5,F7	17) 14.48	17)	17) Pages C80-C86	17) Force ref. F3=11.2 lb-pk; V1,V7= 0°Ø, V3,V5=180°Ø.
18)	18) Decay 47,48	18) Sinewave Dwell & Decay	18)	18) AV1,AV8,AV17,AV24, AL9,F3,OSC. AL1	18) 14.48	18)	18)	18)
19) 9.0 Hz Mode	19) Dwell 10	19) Sinewave Dwell	19)	19) AV1-AV32,AL1-AL18, F1,F3,F5,F7	19) 9.0	19) 11/27/74	19) Pages C52-C58	19) Force ref. F3=17.8 lb-pk; V1,V7= 0°Ø, V3,V5=180°.
20)	20) Decay 49,50	20) Sinewave Dwell & Decay	20)	20) AV1,AV8,AV17,AV24, AL1,AL8,F3,OSC.	20) 9.0	20)	20)	20)
21) 18.7 Hz Mode	21) Dwell 11	21) Sinewave Dwell	21)	21) AV1-AV32,AL1-AL18 F1,F3,F5,F7	21) 18.7	21)	21) Pages C108-C114	21) Force ref. F3=3.8 lb-pk; V1,V7= 0°Ø, V3,V5=180°Ø.
22)	22) Decay 51,52	22) Sinewave Dwell & Decay	22)	22) AV1,AV8,AV17,AV24, AL4,AL16,F3,OSC.	22) 18.7	22)	22)	22)
23) 12.56 Hz Mode	23) Dwell 12	23) Sinewave Dwell	23)	23) AV1-AV32,AL1-AL18 F3, F7	23) 12.56	23)	23) Pages C59-C65	23) Force ref. F3=16.1 lb-pk; V3,V7= 0°Ø.
24)	24) Decay 53,54	24) Sinewave Dwell & Decay	24)	24) AV1,AV8,AV17,AV24, AL1,AL16,F3,OSC.	24) 12.56	24)	24)	24)
25) 13.0 Hz Mode	25) Dwell 13	25) Sinewave Dwell	25)	25) AV1-AV32,AL1-AL18, F1, F5	25) 13	25)	25) Pages C73-C79	25) Force ref. F3=15.4 lb-pk; V1,F5= 0°Ø.
26)	26) Decay 55,56	26) Sinewave Dwell & Decay	26)	26) AV1,AV8,AV17,AV24, AL1,AL16,F1,OSC.	26) 13	26)	26)	26)
27) 16.44 Hz Mode	27) Dwell 14	27) Sinewave Dwell	27)	27) AV1-AV32,AL1-AL18 F1,F3,F5,F7	27) 16.44	27)	27) Pages C94-C100	27) Force ref. F3=14.7 lb-pk; V1,V5= 0°Ø, V3,V7=180°Ø.
28)	28) Decay 57,58	28) Sinewave Dwell & Decay	28)	28) AV1,AV8,AV17,AV24, AL1,AL16,F3,OSC.	28) 16.44	28)	28)	28)
29) 20.4 Hz Mode	29) Dwell 15	29) Sinewave Dwell	29)	29) AV1-AV32,AL1-AL18 F1,F3,F5,F7	29) 20.4	29)	29) Pages C122-C128	29) Force ref. F3=3.2 lb-pk; V1,V5= 0°Ø, V3,V7=180°Ø.
30)	30) Decay 59,60	30) Sinewave Dwell & Decay	30)	30) AV1,AV8,AV17,AV24, AL8,AL12,F3,OSC.	30) 20.4	30)	30)	30)
31) Blocked Roll Stop Evaluation	31) 44 WB through 48 WB	31) Wide Band Sinewave Sweep	31) Per TD	31) AV12,AV9,AV17,F3	31) 1 to 50	31) 12/2/74	31) Pages C129-C136	31) Force applied with 4 shakers; ref. force F3 & others=28.3 lb-pk @ 10 Hz. Steel blocks were inserted between the roll stop rollers & the car for this test series; V1,V3, V5,V7=0°Ø for run 44 WB; V1,V3=0°Ø V5,V7=180°Ø for run 45 and 48 WB; V1,V7=0°Ø, V3,V5=180°Ø for run 46 WB; V1,V5=0°Ø, V3,V7=180°Ø for run 47 WB.

TABLE III (continued)

TEST SEQUENCE	RUN NO.	TEST DESCRIPTION	TEST REFERENCE	RECORD MEASUREMENTS	TEST FREQUENCY (HZ)	TEST DATE	DATA REFERENCE	REMARKS
32) Blocked Roll Stop Evaluation	32) 49 WB through 56 WB	32) Wide Band Sinewave Sweep	32) Per TD	32) AV12,AV9,AV17,F3	32) 1 to 50	32) 12/3/74	32) Pages C137-C148 Data Included In Appendix C	32) Force applied with 4 shakers; ref. force F3 & others=28.3 lb-pk @ 10 Hz. Wooden blocks were wedged between the car and roll stop pads. Wedges were removed along one side for runs 53-56 WB; V1,V3,V5,V7=0°Ø for runs 49 & 56 WB; V1,V3=0°Ø, V5,V7=180°Ø for runs 50 & 55 WB; V1,V7=0°Ø, V3,V5=180°Ø for runs 51 & 54 WB; V1,V5,=0°Ø, V3,V7=180°Ø for runs 52 and 53 WB.

NOTE: Force multipliers with a gain of 10 were used with shakers V1, V3, V5 and V7.

TABLE IV. MODE FREQUENCY/DAMPING SUMMARY

Freq. (Hz)	Mode Description	Damping % of Critical	Data Page No.
	CONFIGURATION 1 - CAR EMPTY		
3.45	Rigid Body Suspension, Roll Mode	29	A26
6.75	1st Torsional Mode	11	A39
17.64	2nd Torsional Mode	0.34	A48
29.57	1st Vertical Bending Mode	0.61	A56
	CONFIGURATION 2 - CAR FULL		
2.15	Rigid Body Suspension, Vertical Mode	24	B2
3.3	Rigid Body Suspension, Roll Mode	15	B13
6.3	1st Torsional Mode	11	B20
8.85	2nd Torsional Mode	2.1	B41
11.9,12.3	1st Vertical Bending Mode	2.4,2.0	B50
13.6	3rd Torsional Mode	2.2	B56
14.55,14.75	1st Vertical Bending Mode	5.5,5.5	B73
17.1	2nd Vertical Bending Mode	2.0	B86
20.2	2nd Vertical Bending Mode	11	B93
	CONFIGURATION 3 - SYSTEM TEST		
2.126	Rigid Body Suspension, Vertical Mode	2.4	C2
2.85	Rigid Body Suspension, Pitch Mode	3.1	C16
3.15	Rigid Body Suspension, Roll Mode	2.0	C23
6.3	1st Torsional Mode	3.7	C32
6.31	Vertical Suspension Mode/W Friction Pads		C45
9.0	2nd Torsional	1.8	C52
12.56	Vertical Bending	2.8	C59
12.79	1st Vertical Bending Mode	2.8	C66
13.0	Vertical Bending	2.2	C73
14.48	3rd Torsional Mode	2.8	C80
14.96	1st Vertical Bending Mode	2.8	C87
16.44	Torsional Mode	2.3	C94
17.9	2nd Vertical Bending Mode	3.7	C101
18.7	Torsional Mode	7.3	C108
19.5	2nd Vertical Bending Mode	5.5	C115
20.4	Torsional Mode	2.2	C122

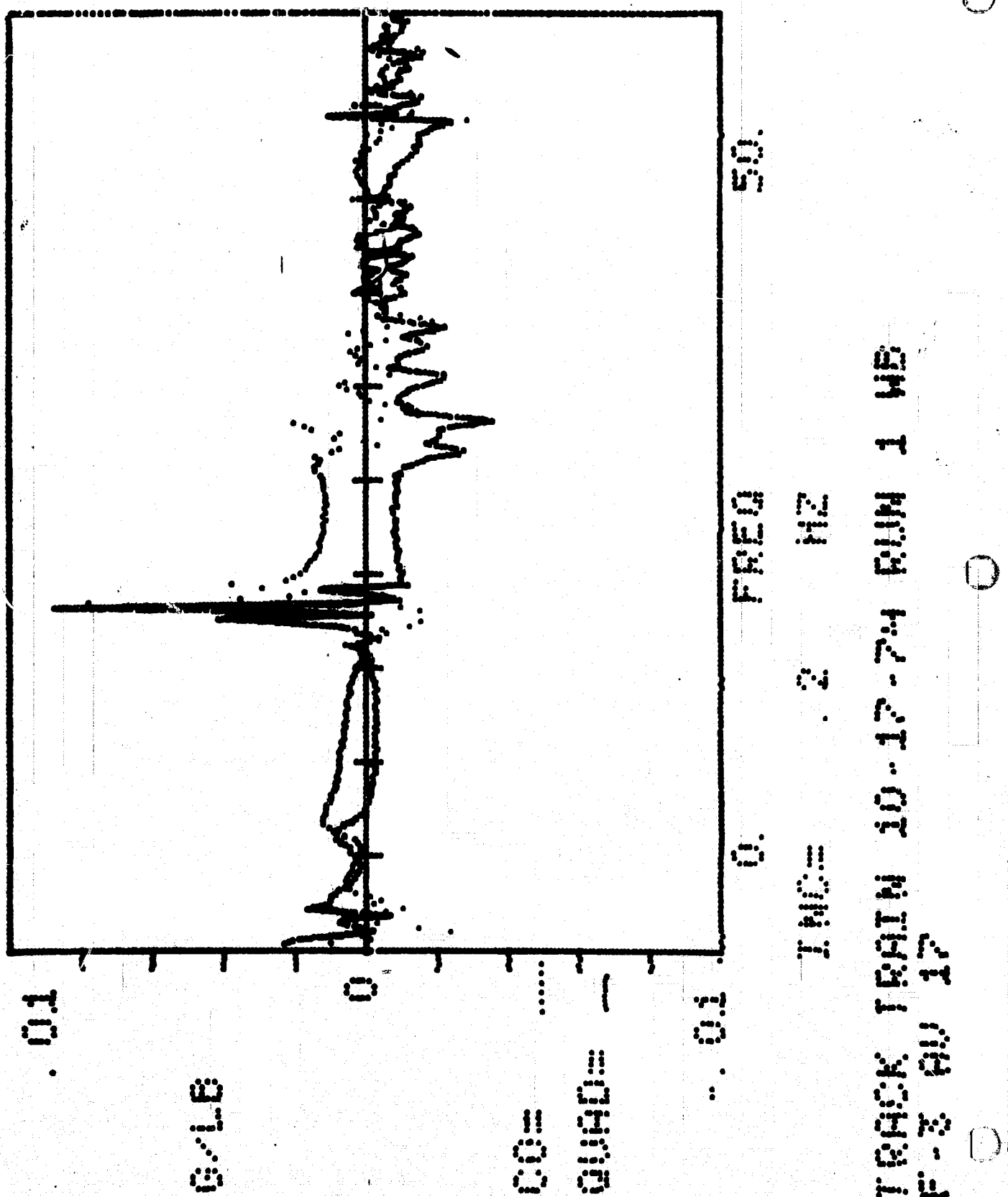
APPENDIX A

Configuration 1, Car Empty

Test Data

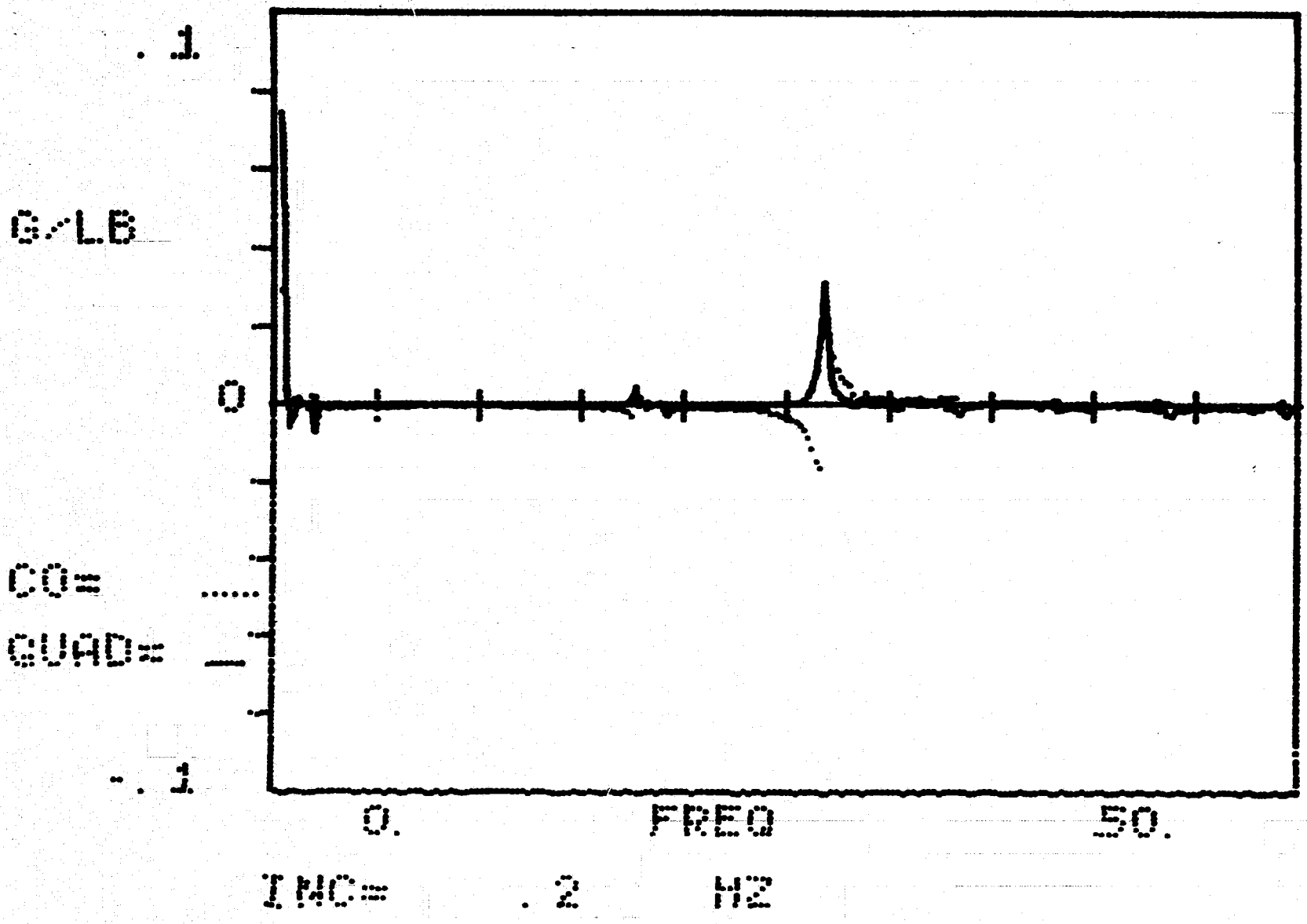
FORCE MULTIPLIER EVALUATION

FORCE MULTIPLIER EVALUATION

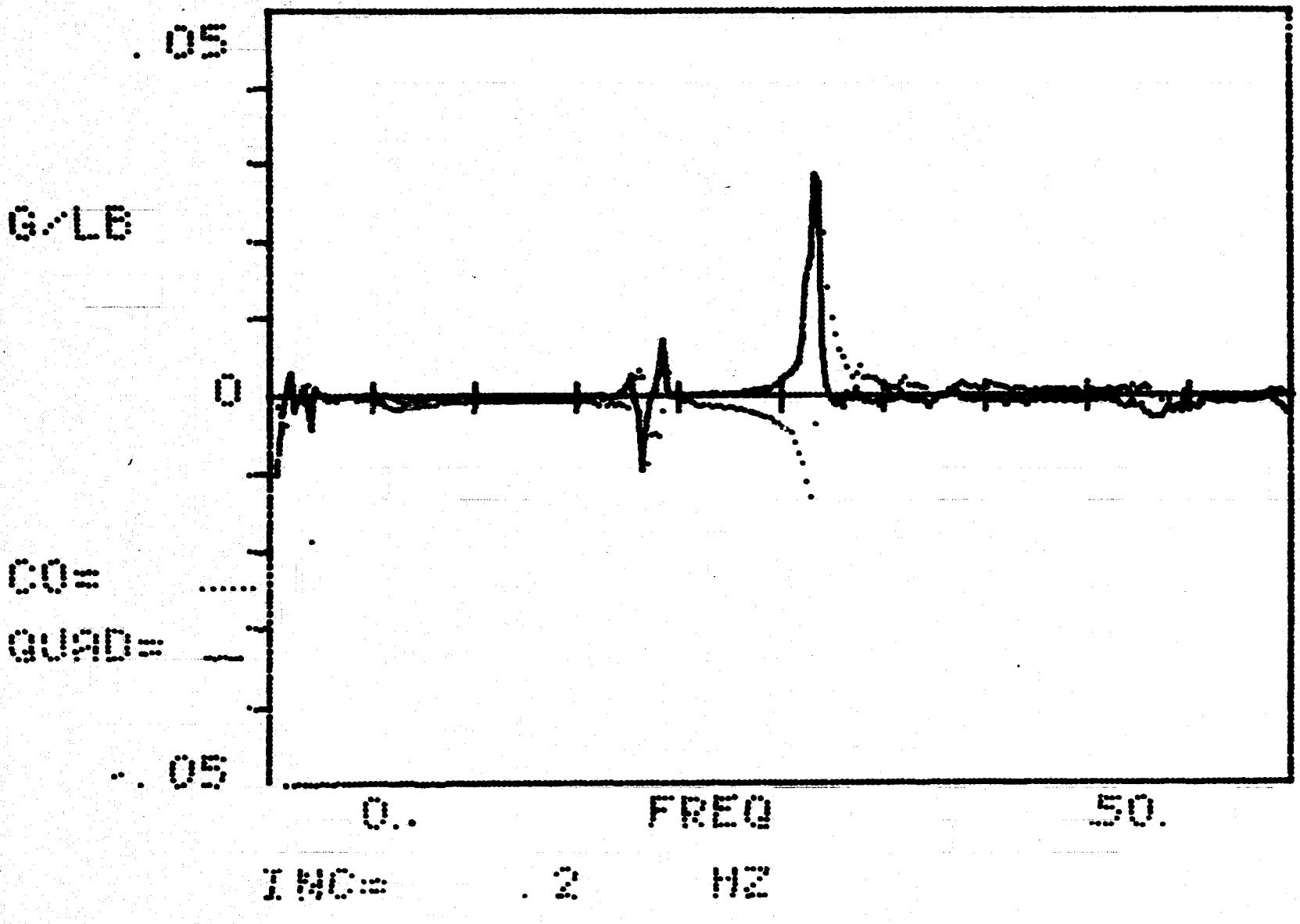

TRACK 1 BATH 10-17-74 RUN 1 WB
FREQ
TIME
0.1
0
0.1
dB
dB

TRACK TRAIN 10-17-74 RUN 2 WB
F-3 AV 20

ORIGINAL PAGE IS
OF POOR QUALITY

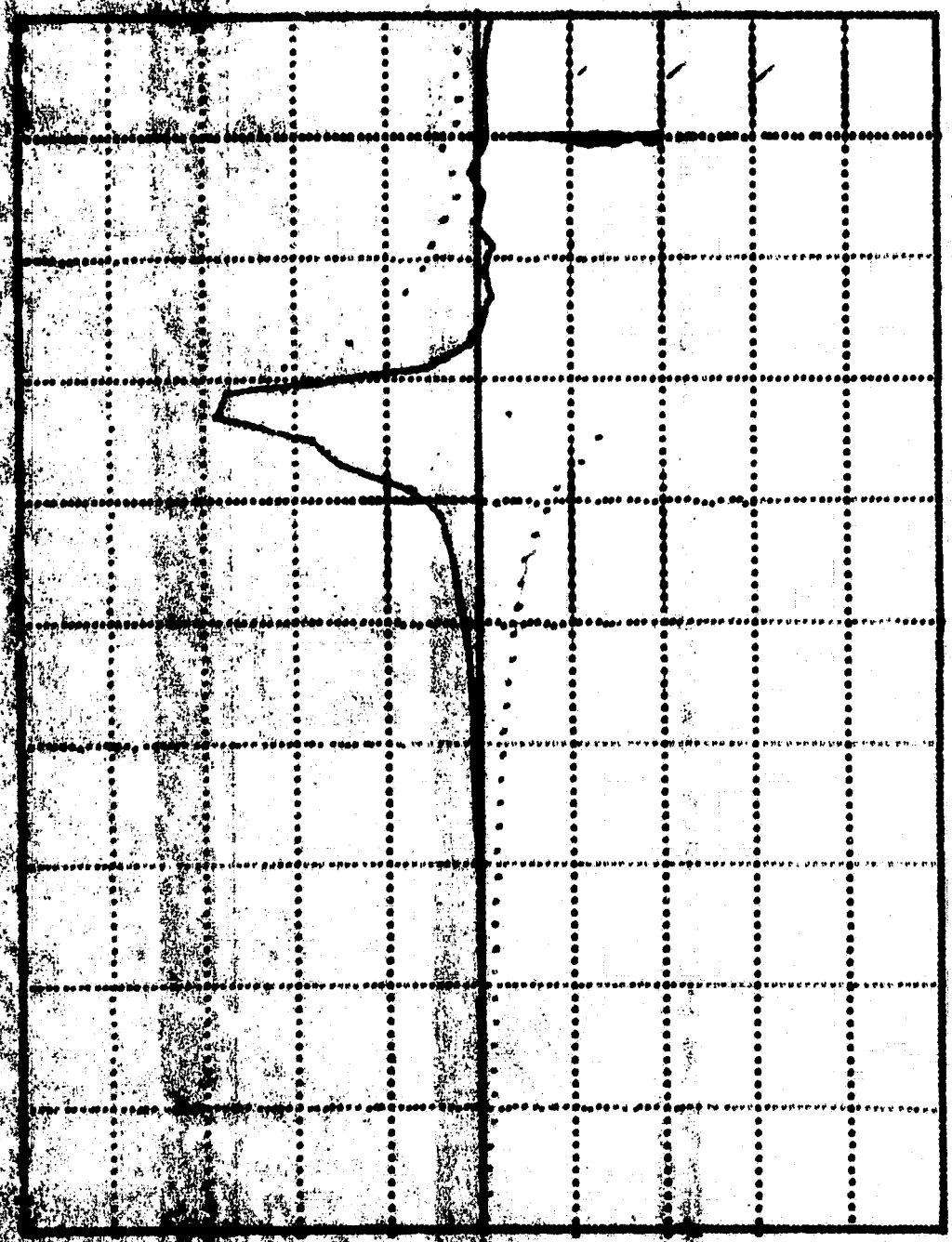


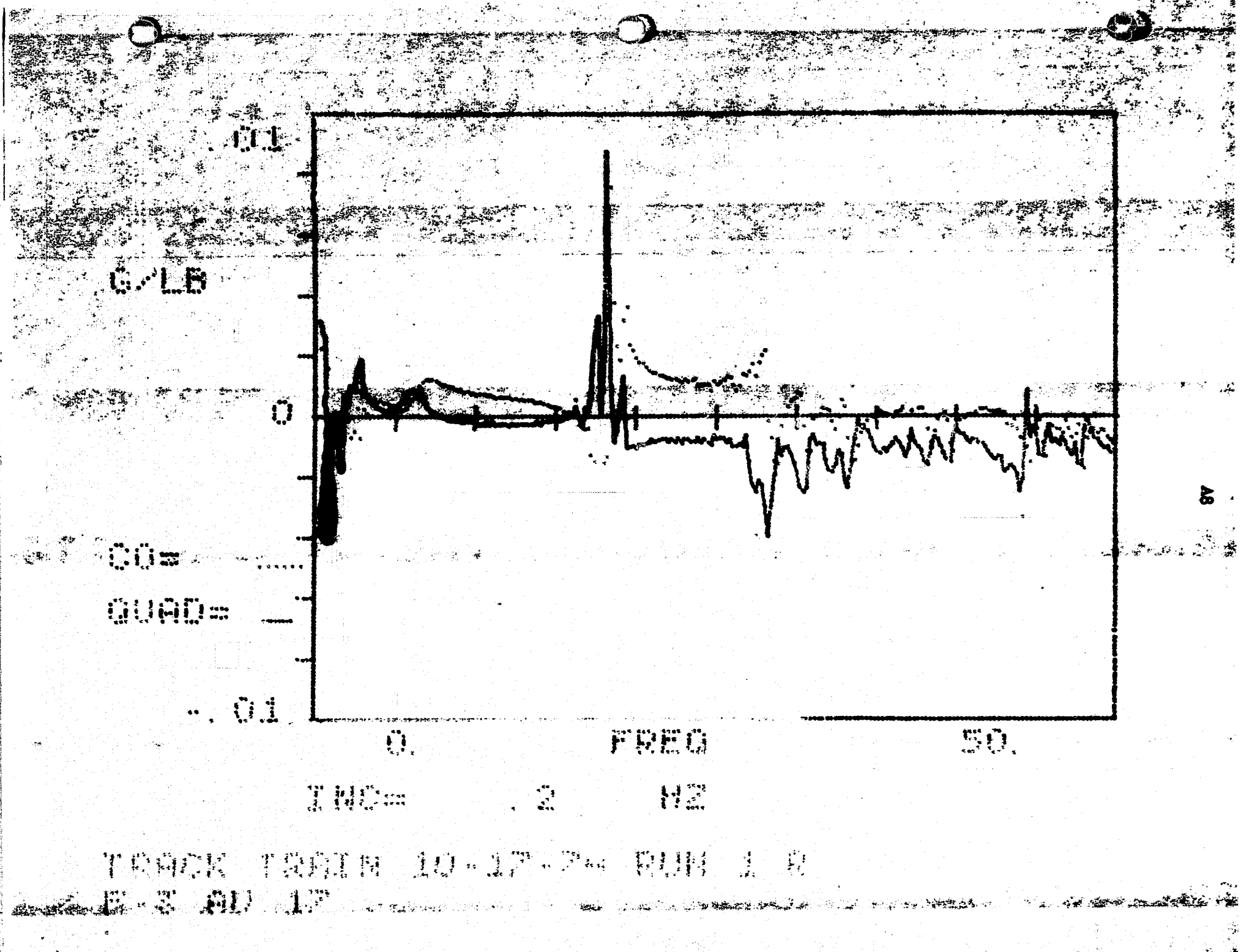
TRACK TRAIN 10-17-74 RUN 3 WB
F-3 AV 21



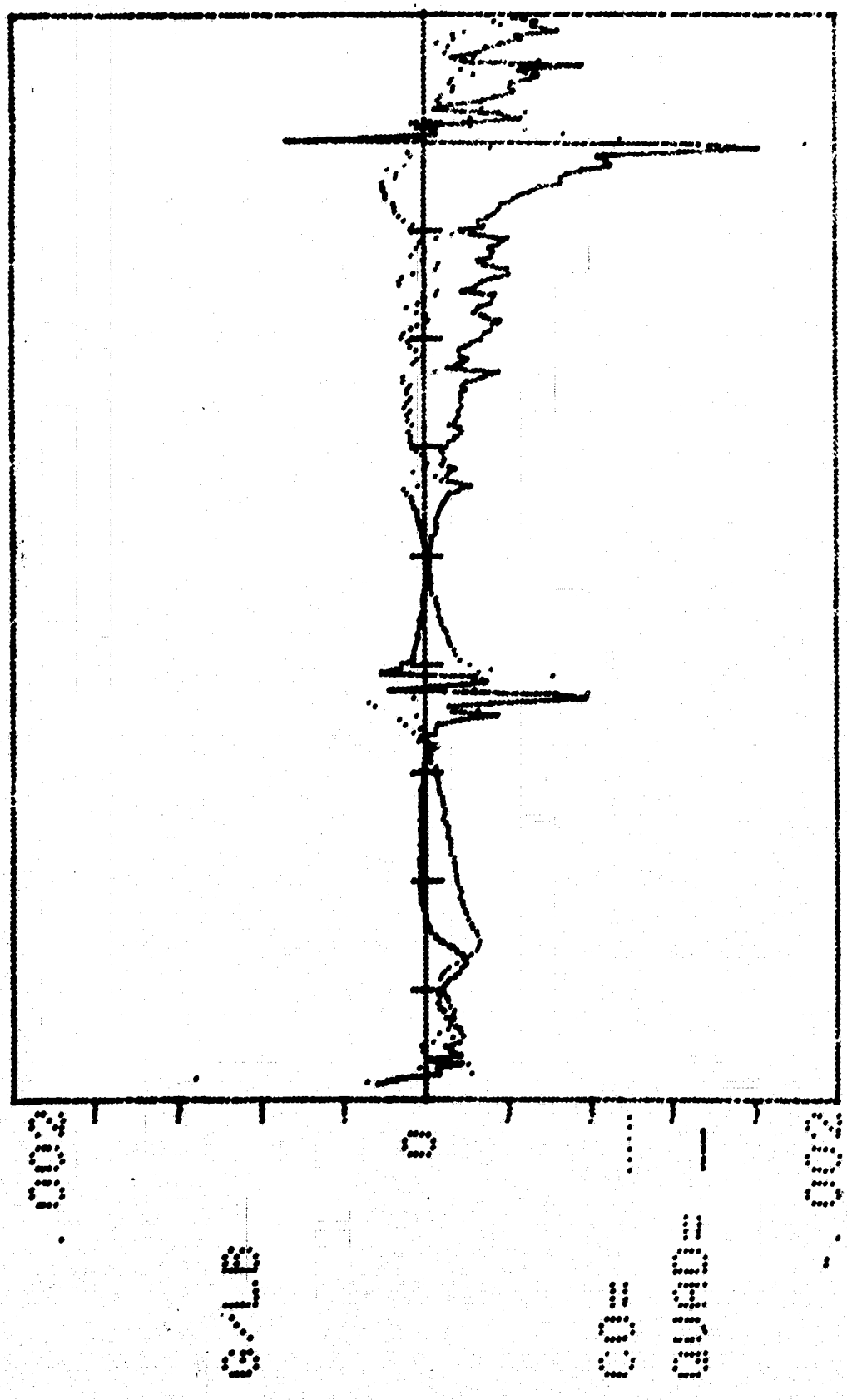
TRACK TRAIN 10-17-74 RUN 4 WB
F-3 AW 24

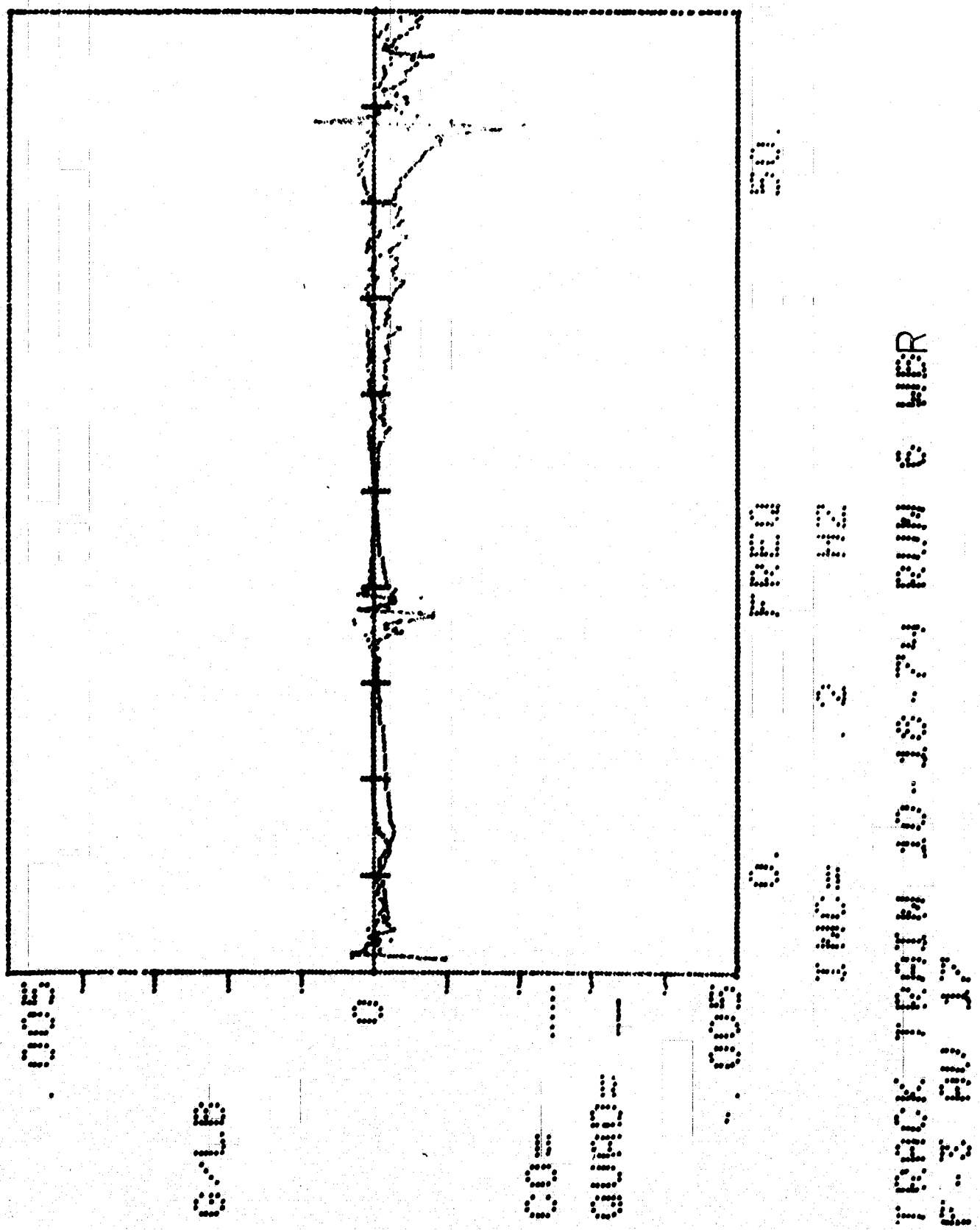
ORIGINAL PAGE IS
OF POOR QUALITY

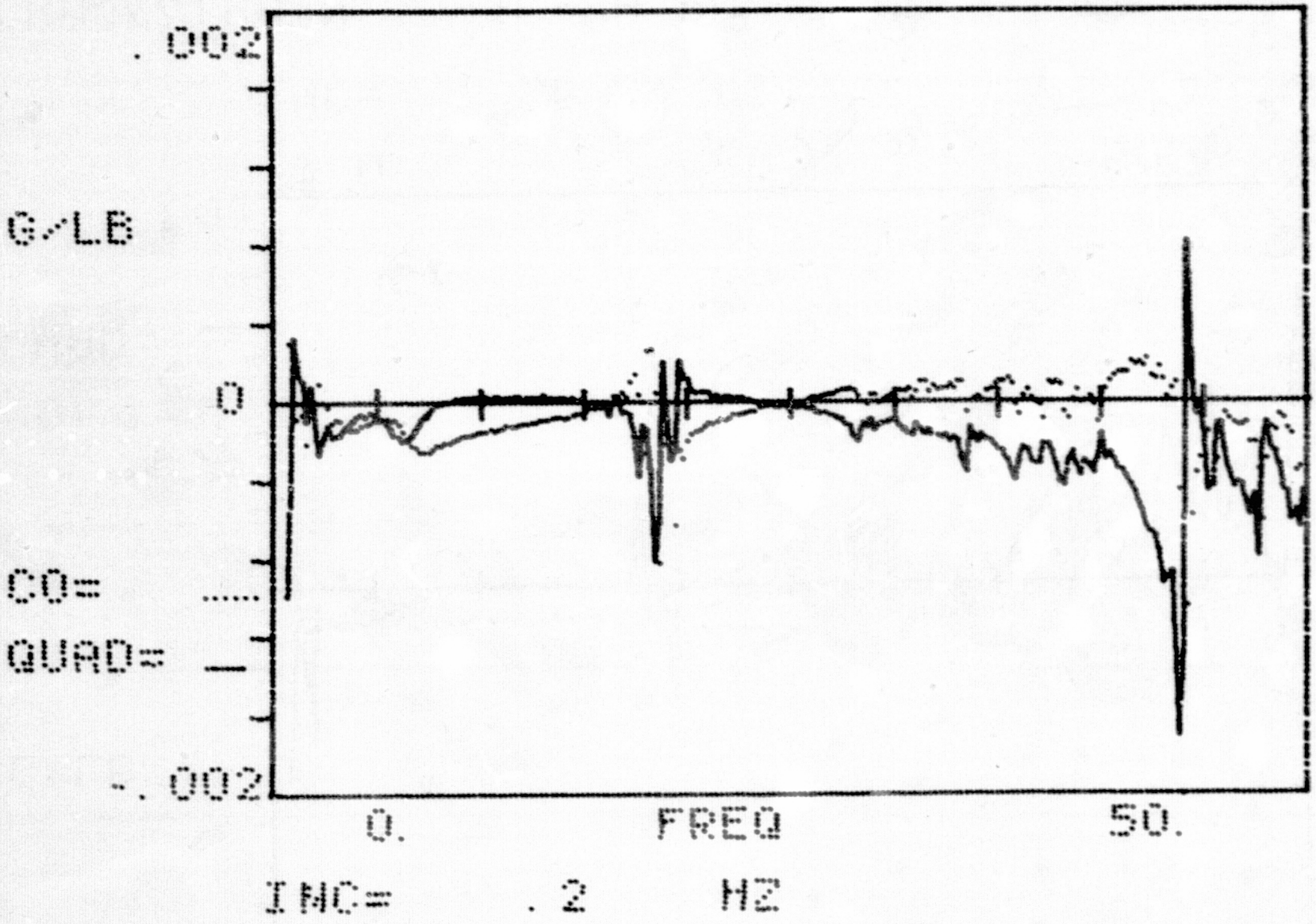



.01
G/LB
0
-.01
0.
FREQ
50.
46

.05
0
-.05
0.
FREQ
50.
TRACK 1 RUN 10-10-24 RUN 5 MB
P-3 80 38

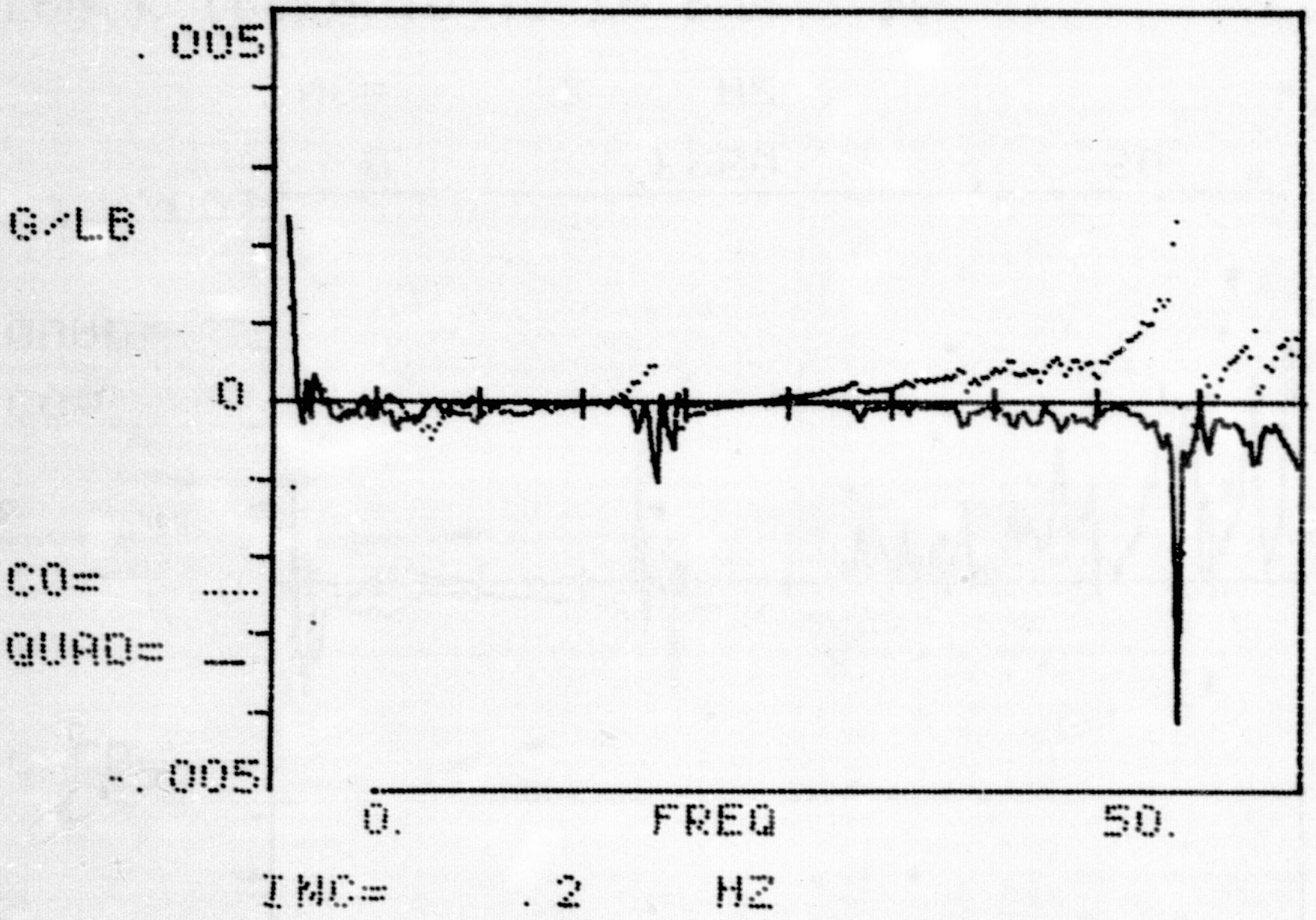

6 dB
0 dBm
-10 dBm
-20 dBm
CENTER 1.0 GHz
SPAN 0 Hz
RES BW 3.0 kHz
VBW 3.0 kHz
SWEEP 15 min


TRACK: BEAM 0.: 10.7 GHz BAND 6 WBR
1: 8.2 GHz
2: 8.4 GHz
BEAM 0.
0.
0.08
0
-0.08
-0.16
dB



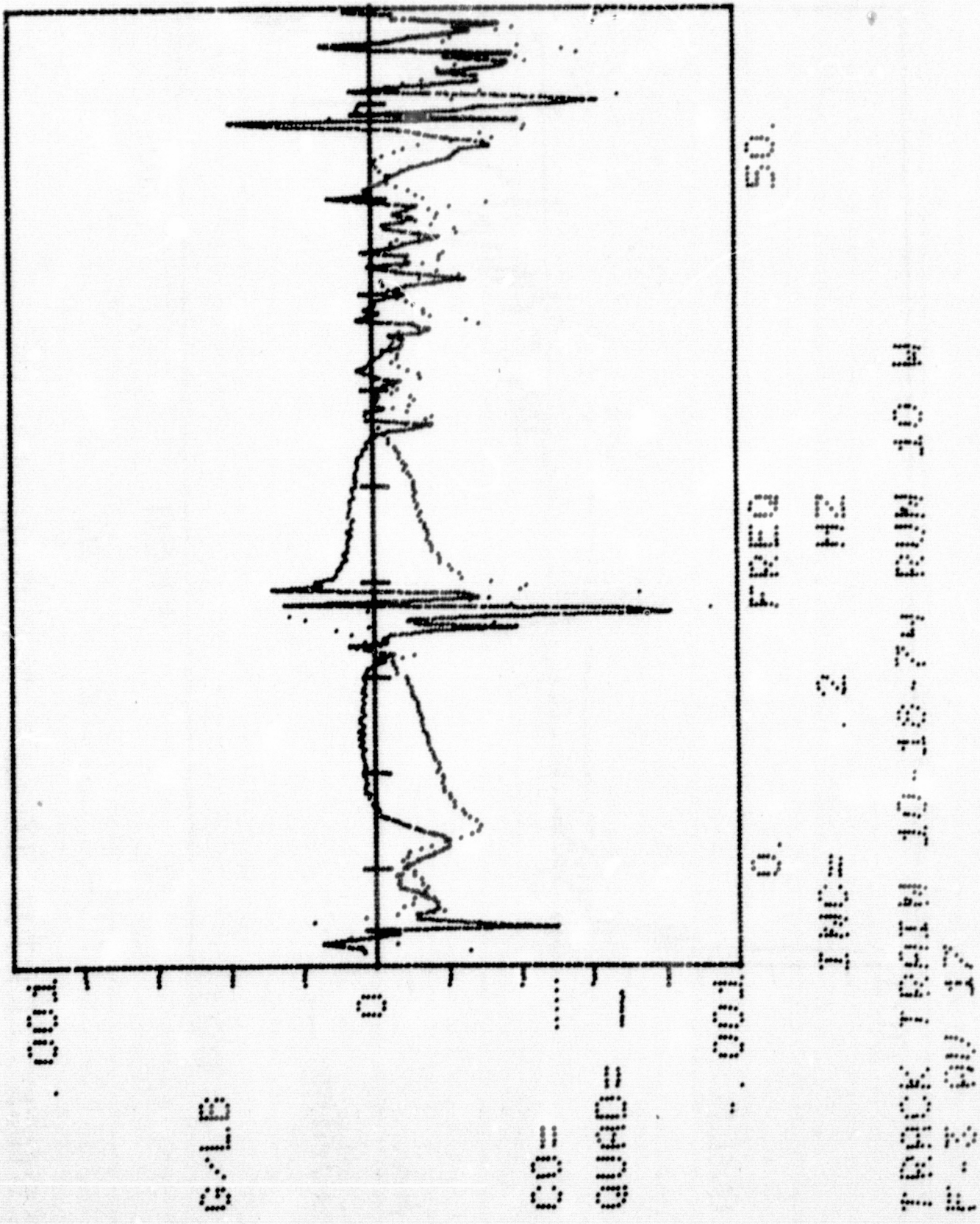
TRACK TRAIN 10-18-74 RUN 6 WBR
F-3 AV 17

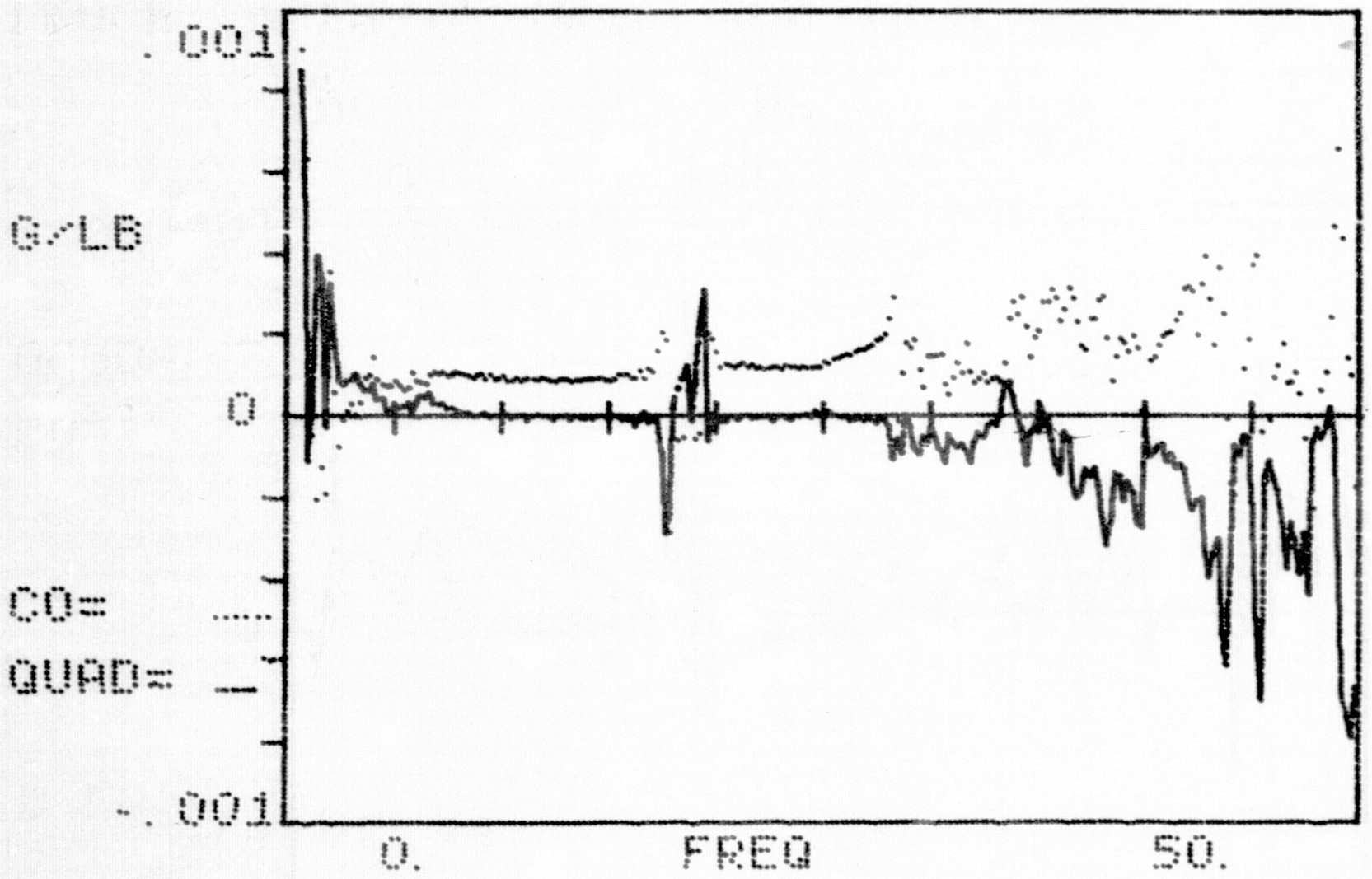
TRACK TRAIN 10-18-74 RUN 7 WB
F-3 AV 20



TRACK TRAIN 10-18-74 RUN 8 WB
F-3 AL 1 (AL1 MOVED TO VERTICAL POSITION NEXT TO AV17)

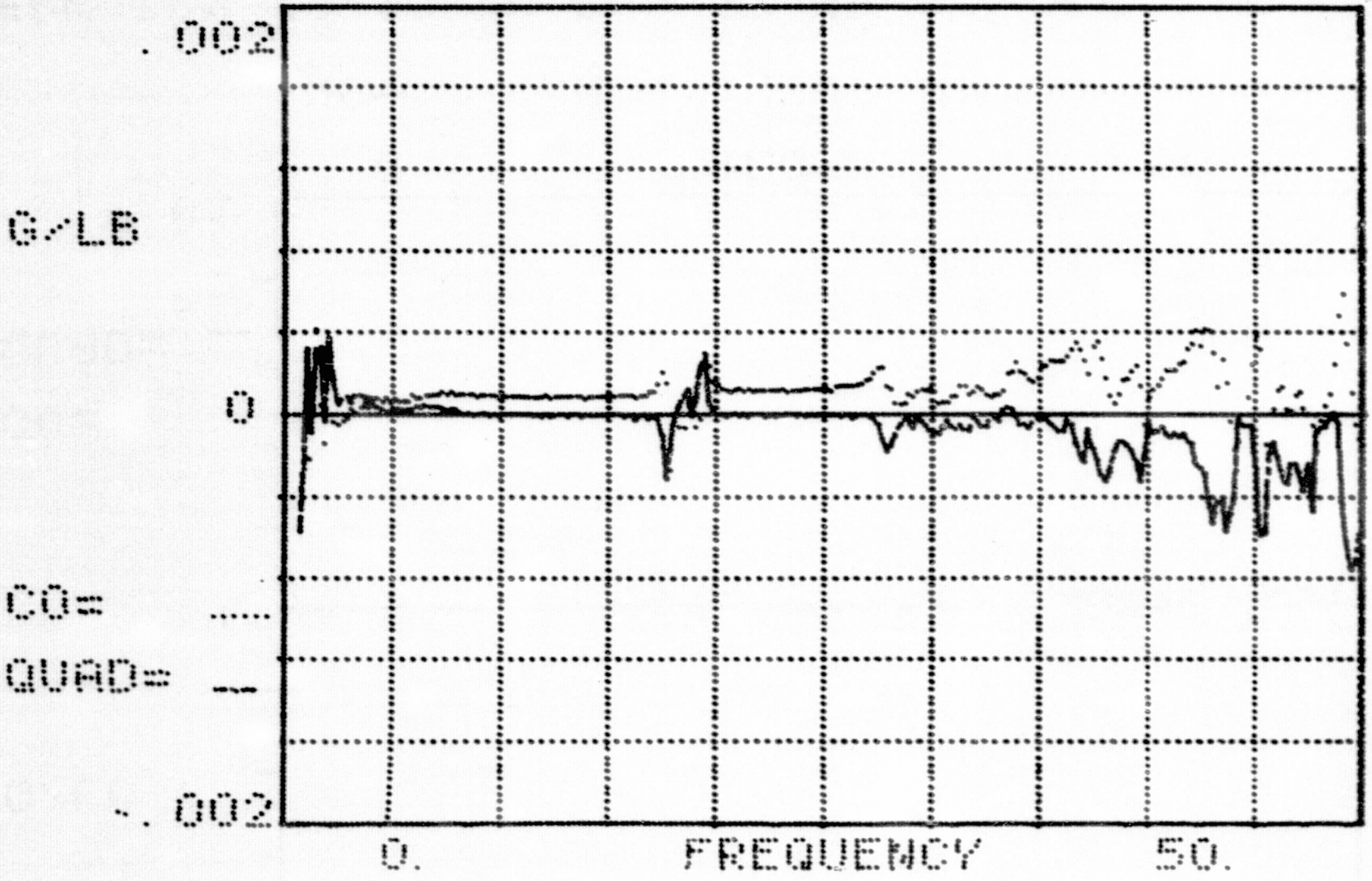
TRACK TRAIN 10-18-74 RUN 9 WB
F-3 AV 21


0.001
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3.0
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.9
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
5.0

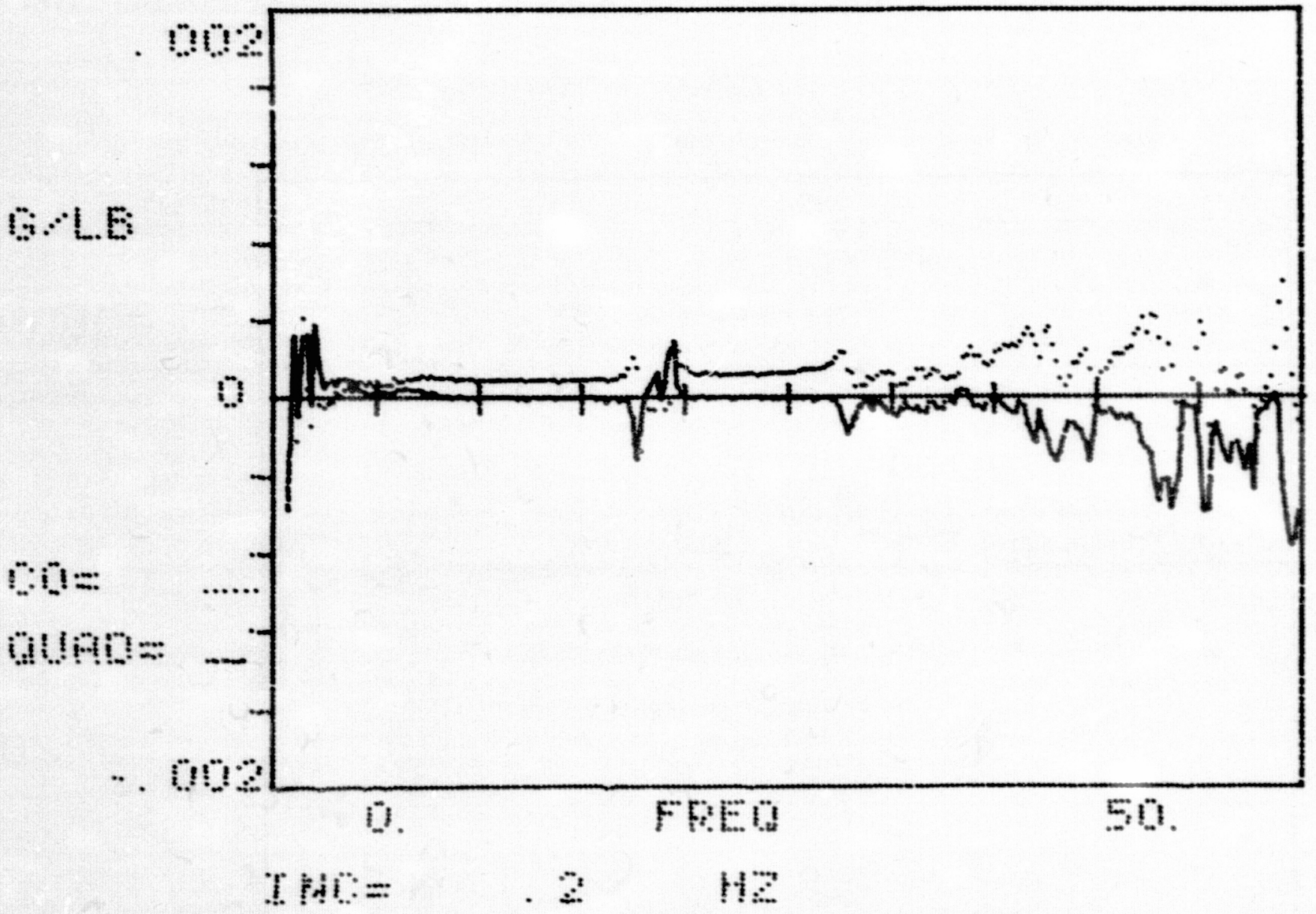


TRACK TRAIN 10-18-74 RUN 11 W
F-3 AV 20

TRK TRM 10-18-74 RUN 12 WB
F-3 DW 20



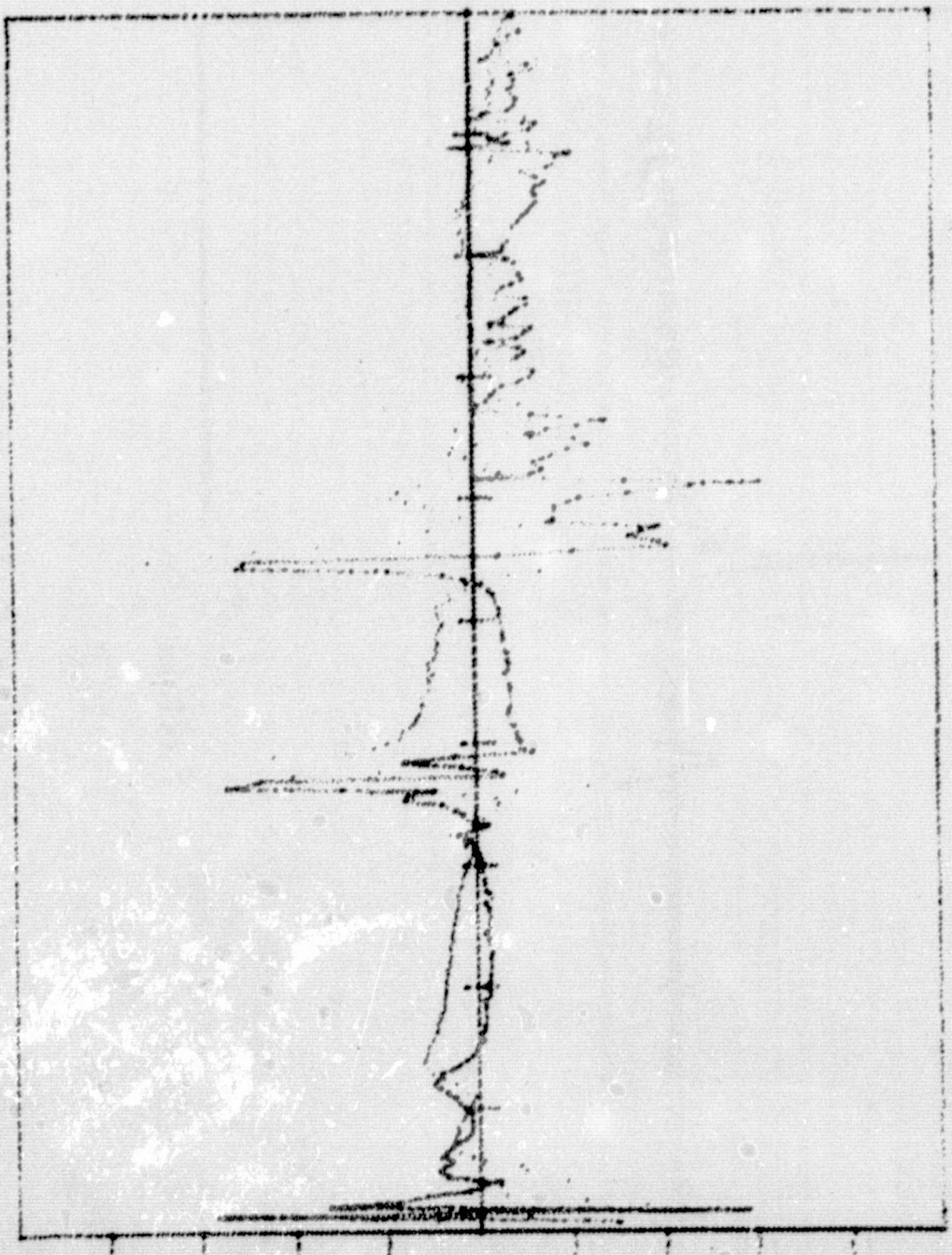
TRK TRM 10-18-74 RUN 12 MB
E-3 AV 20

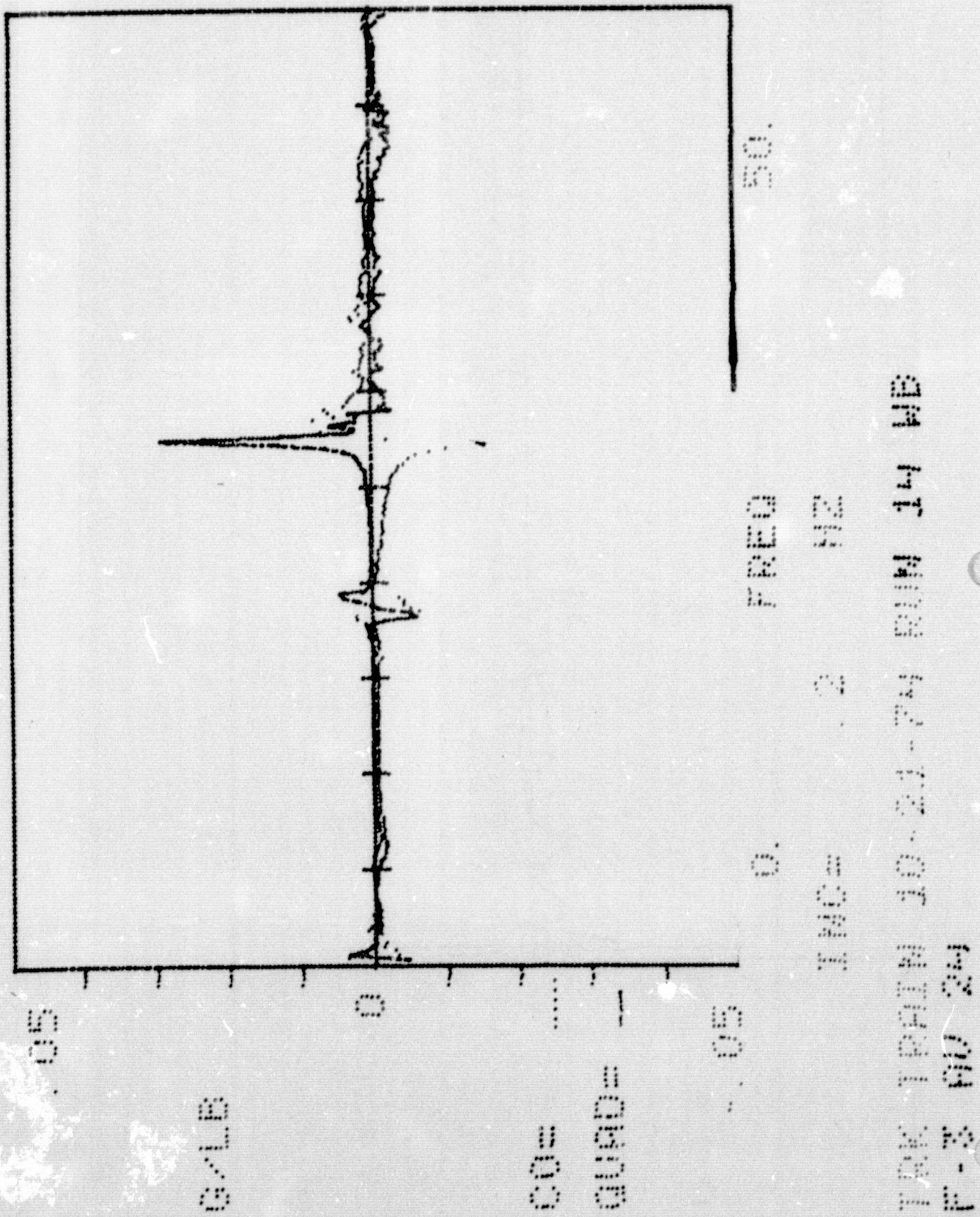


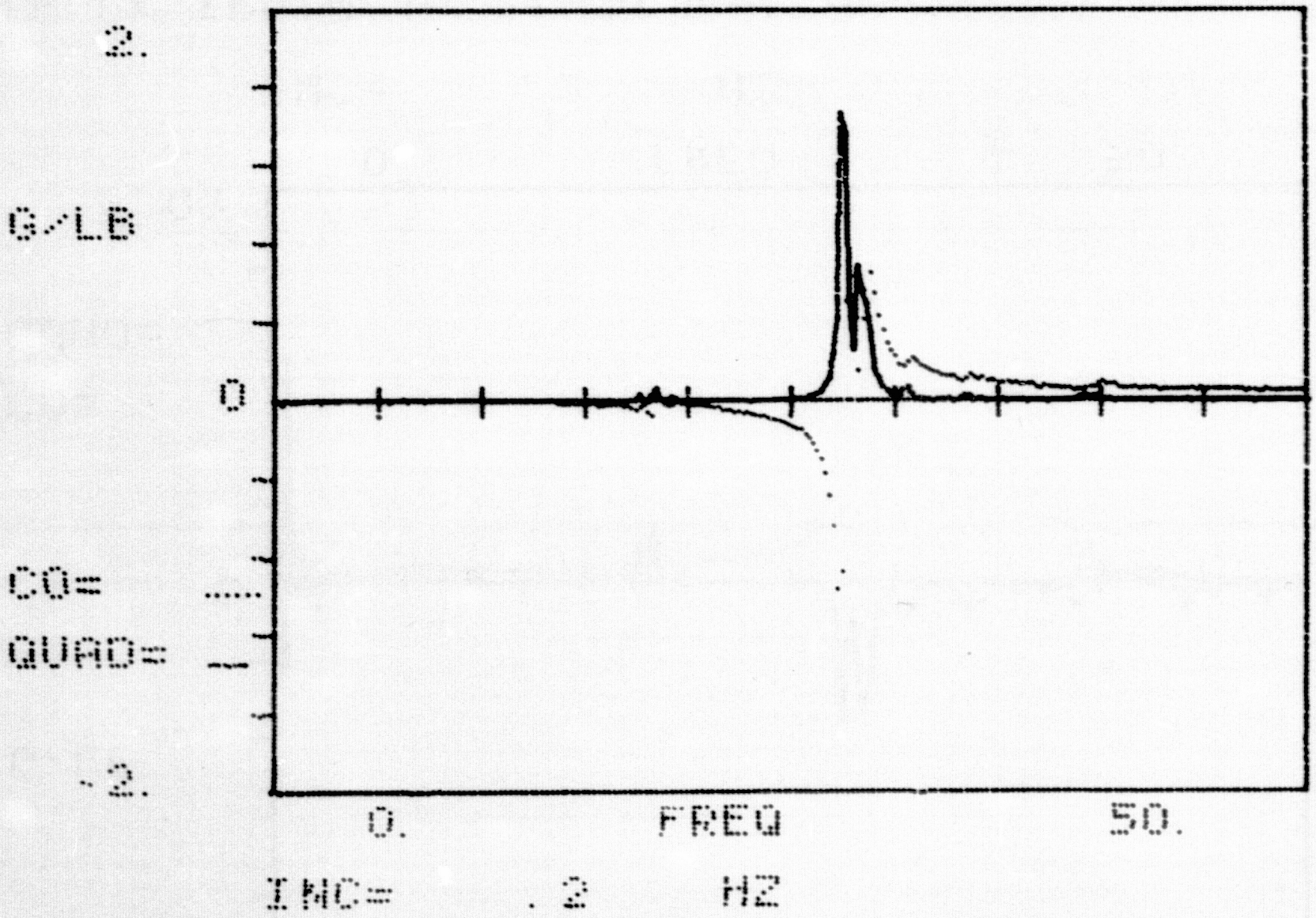
TRK TRM 10-18-74 RUN 12 WB
F-3 AV 20

.02
0
-.02
0./LB
OD=
QUAD=
0.
FREQ
50.
INC= .2 HZ
TRK TRAIN 10-21-74 RUN 13 WB
PC-8 DV 17

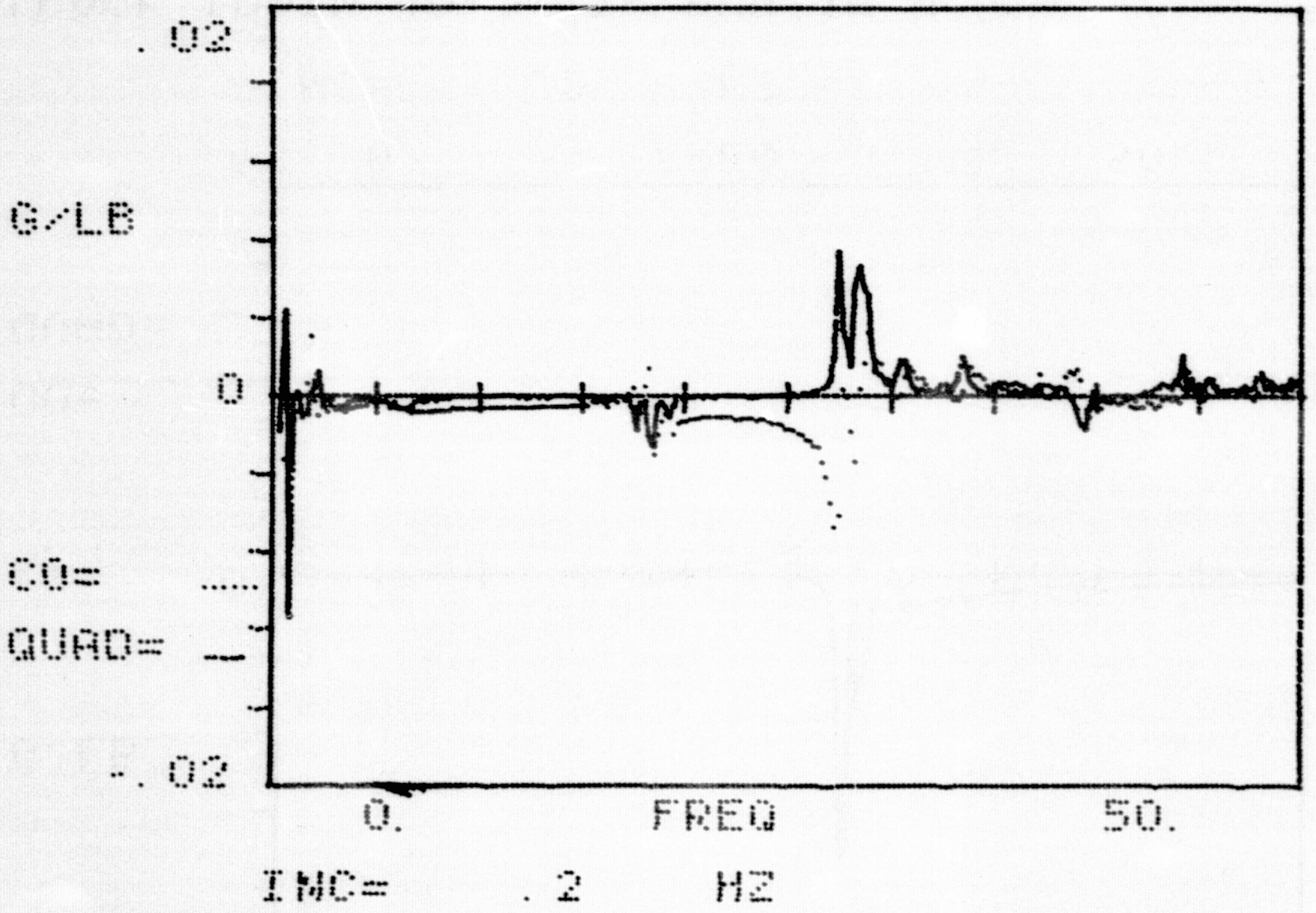
ORIGINAL PAGE IS
OF POOR QUALITY




0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
-7.0
-7.5
-8.0
-8.5
-9.0
-9.5
-10.0
-10.5
-11.0
-11.5
-12.0
-12.5
-13.0
-13.5
-14.0
-14.5
-15.0
-15.5
-16.0
-16.5
-17.0
-17.5
-18.0
-18.5
-19.0
-19.5
-20.0

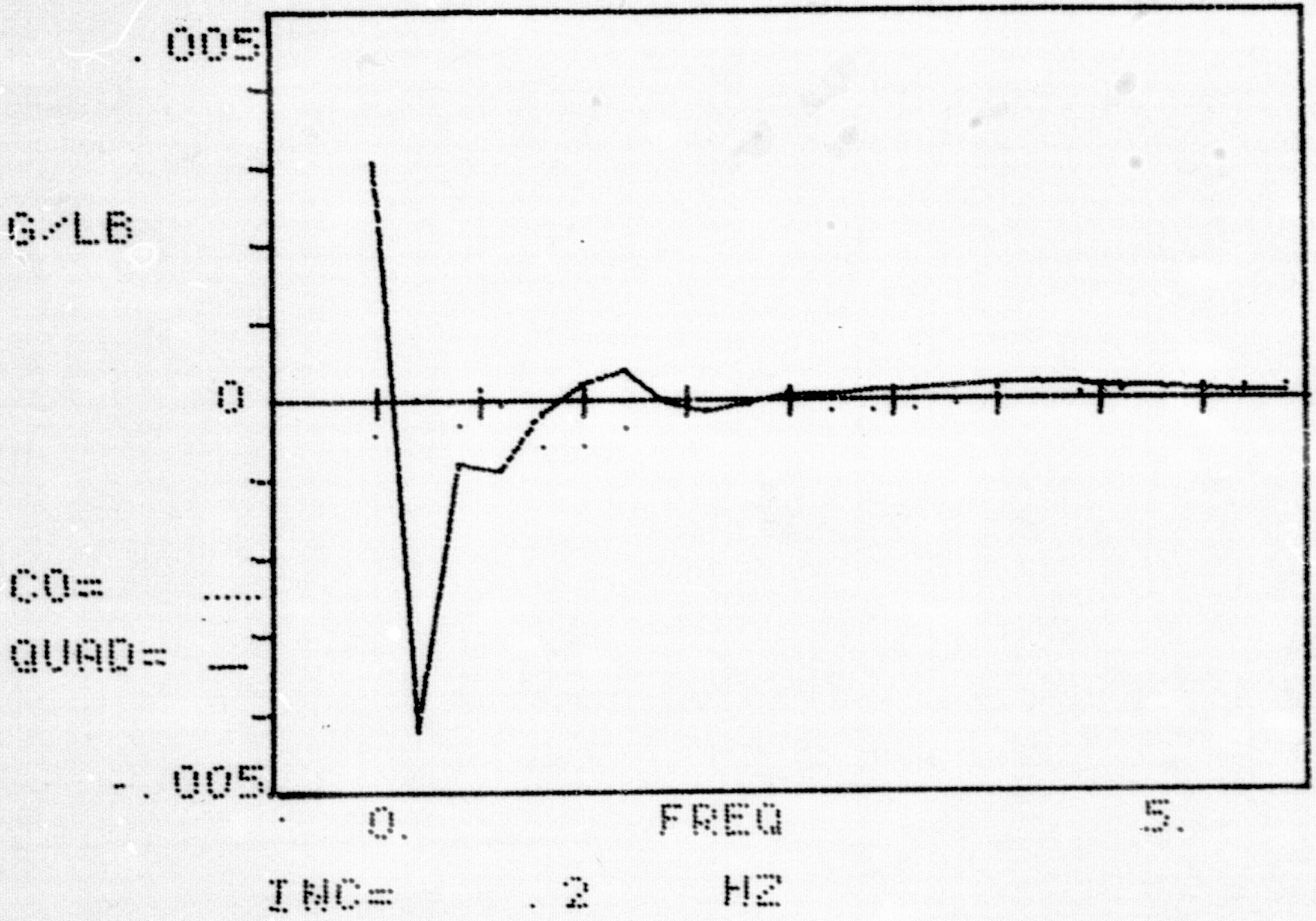


TRACK TRAIN 10-21-74 RUN 15 W
F-3 AL18

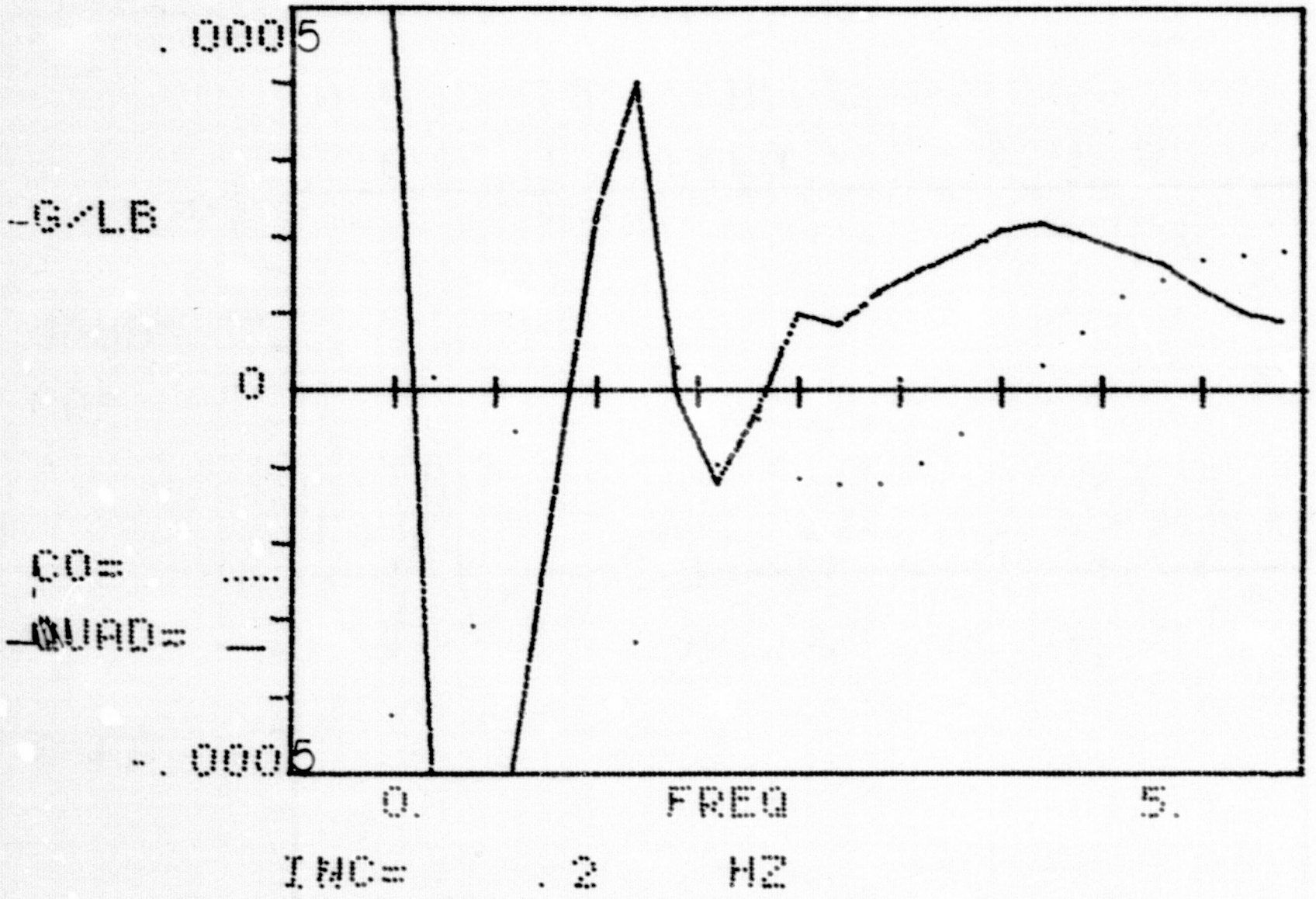


TRACK TRAIN 10-21-74 RUN 16 H
F-3 AL1

3.45 HZ
MODE



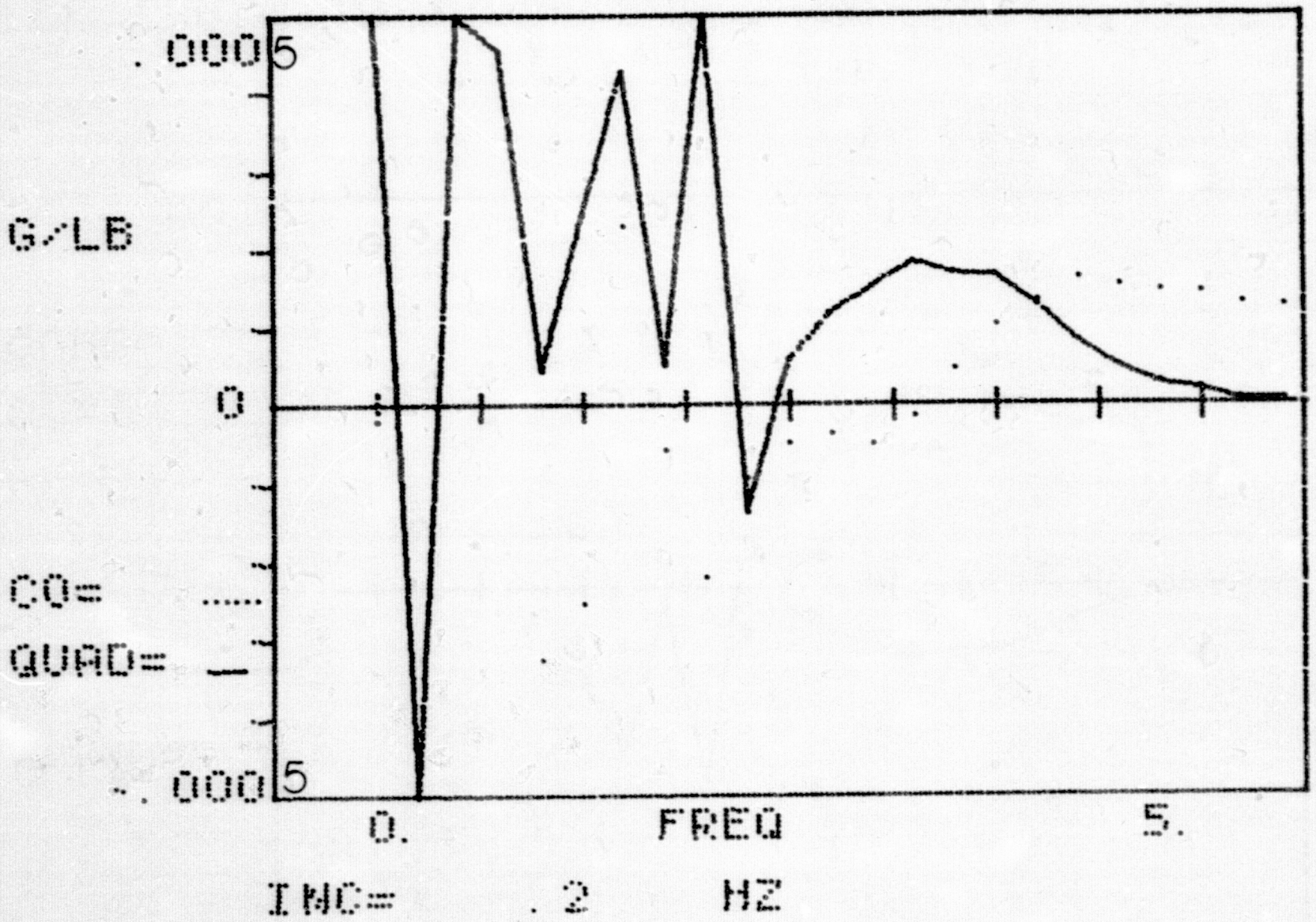
TRK TRAIN 10-23-74 RUN 2 NB
F3/AV1



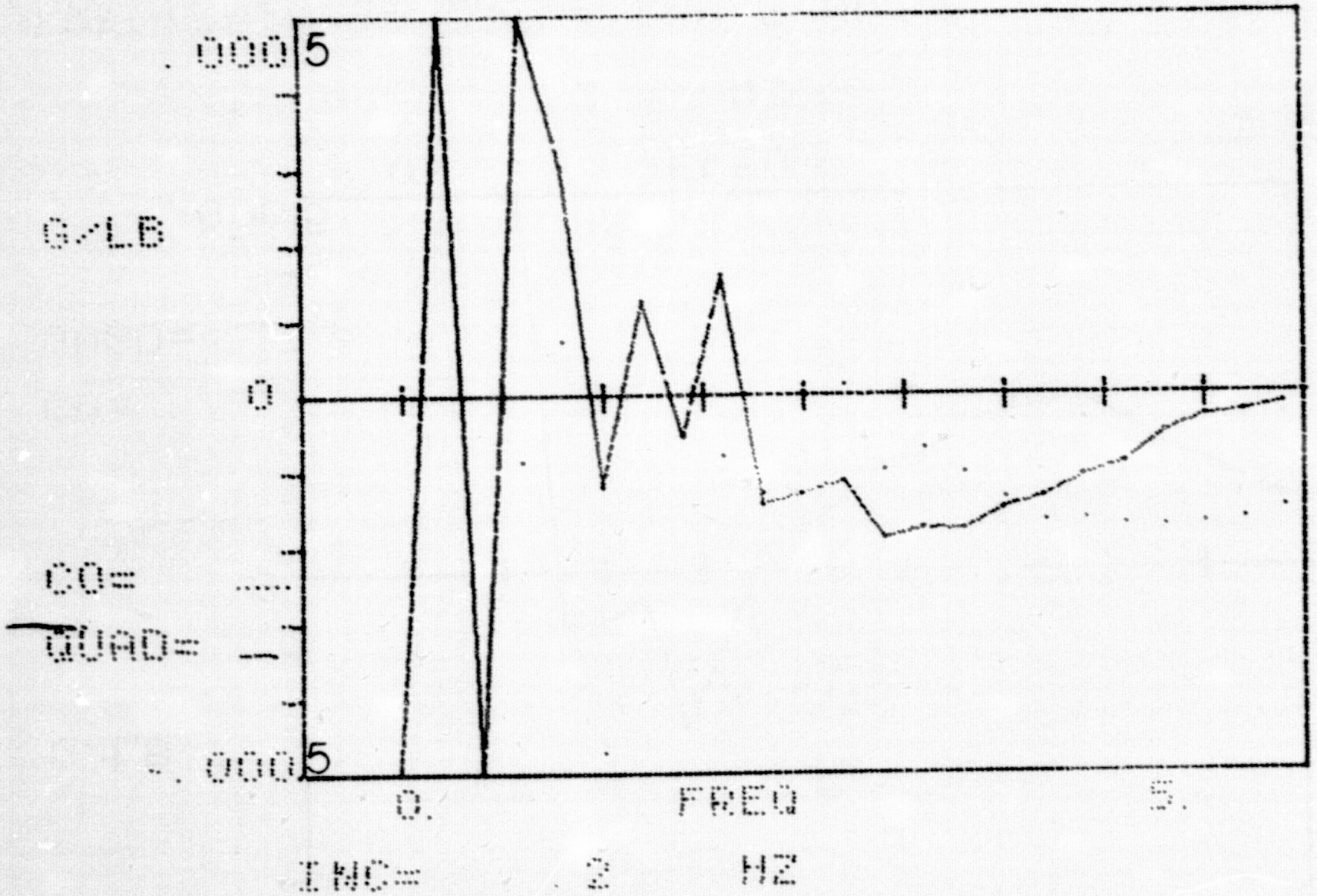
TRK TRAIN 10-23-74 RUN 2 MB
F3/AV1

.02
G/CB
0
CO=
QUAD=
-.02
0.
FREQ
5.
INC= .2 HZ
TRK TRAIN 10-23-74 RUN 3 MB
F3/AV8

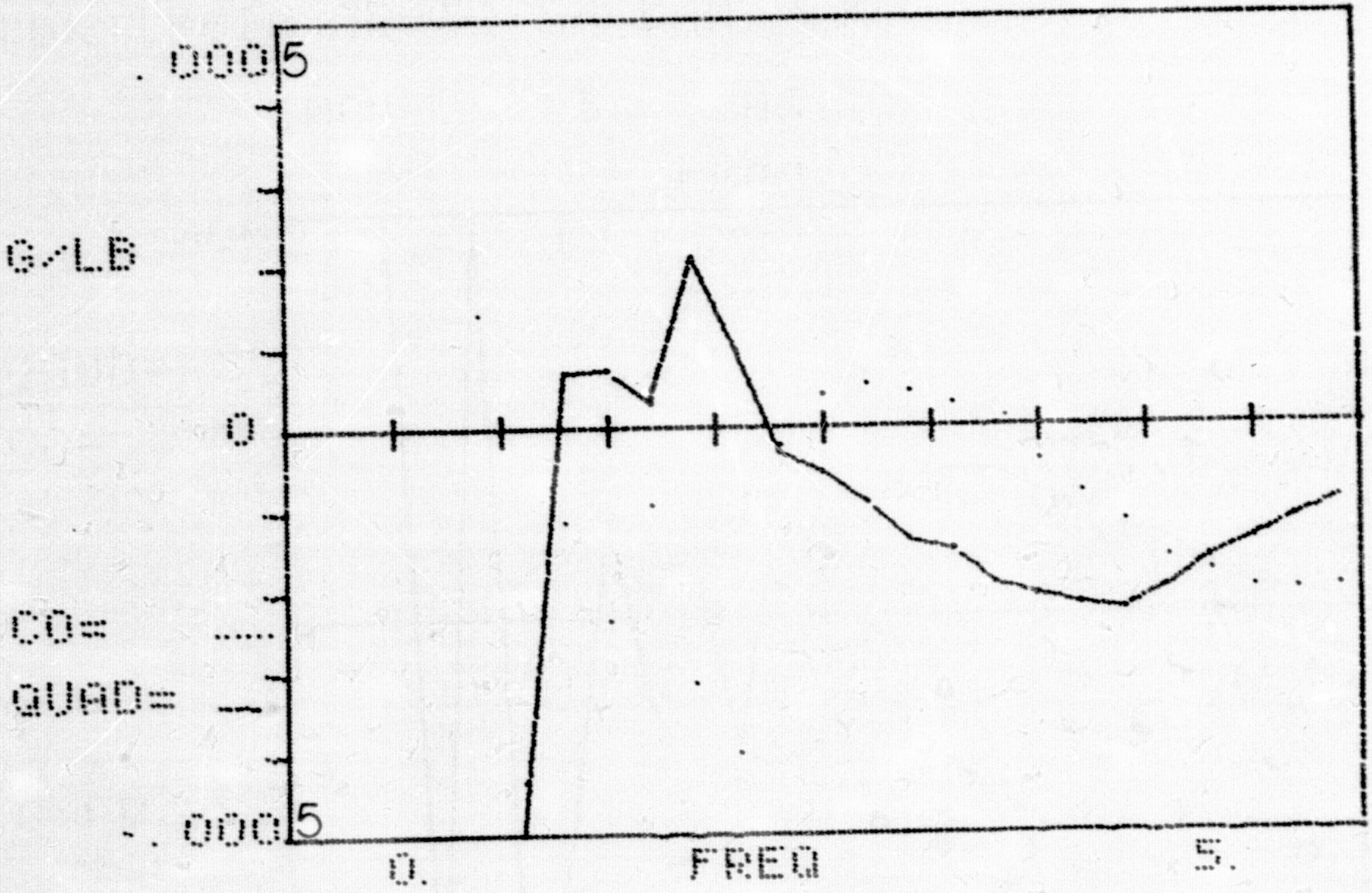
.001
0
-.001
0./LB
CO=
QUAD=
0.
FREQ
5.
INC= .2 HZ
TRK TRAIN 10-23-74 RUN 3 NB
F3.AVS



TRK TRAIN 10-23-74 RUN 3 MB
F3/AV8



TBK TRAIN 10-23-74 RUN 4 MB
F3/AV17



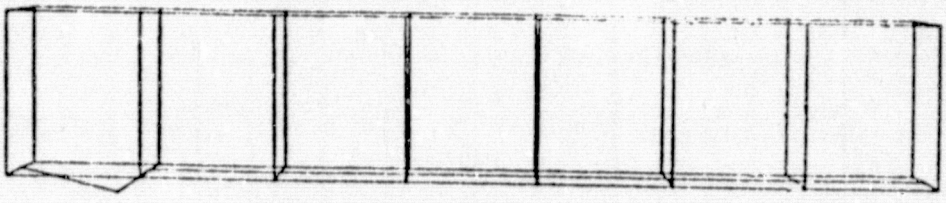
TRK TRAIN 10-23-74 RUN 5 MB
F3/AV24

3.45 HZ MODE

MEAS. NO'S.	CO	QUAD			
*AV1/F1	-0.6E-04	-2.3E-04			
AV8	-1.9E-04	-1.8E-04			
AV17	1.0E-04	1.8E-04			
AV24	-0.2E-04	2.4E-04			
F3	-1.18	5.886E-02			
F5	-1.163	7.699E-02			
F7	1.171	-5.712E-02			

* Tuning Measurements - AV1, F1 = 63.65 lb-pk

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR UNDEFLECTED MODEL

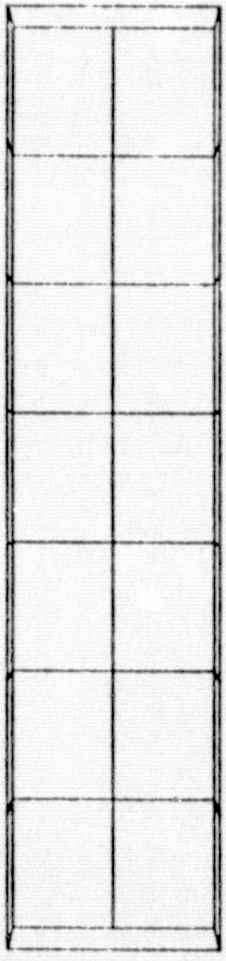
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH01
DATE = 06DE74

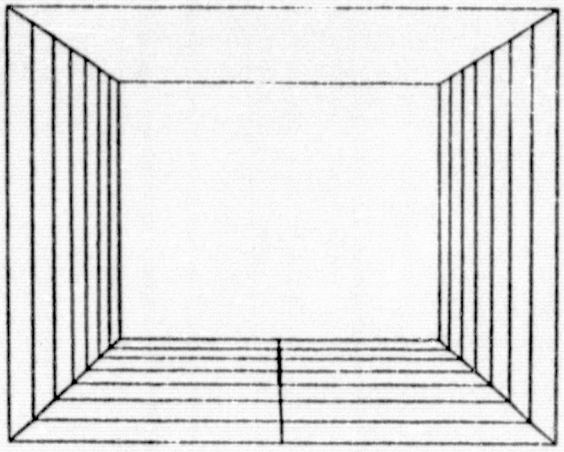
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+03	Z = 0.	
RUN NO. = ORTH01	DATE = 06DE74	

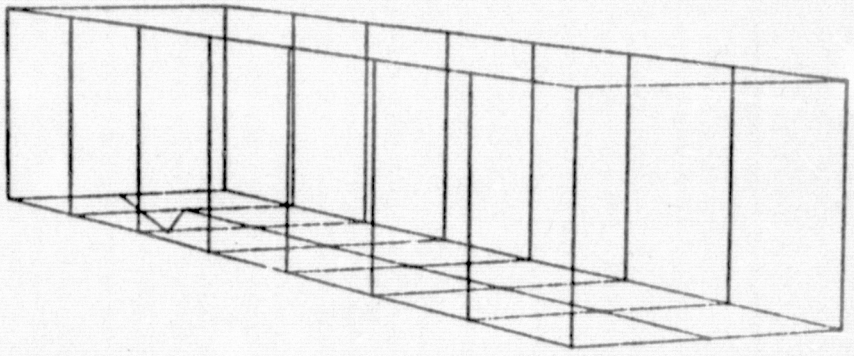
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = [illegible]0 IN
RUN NO. = ORTH01	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR UNDEFLECTED MODEL

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

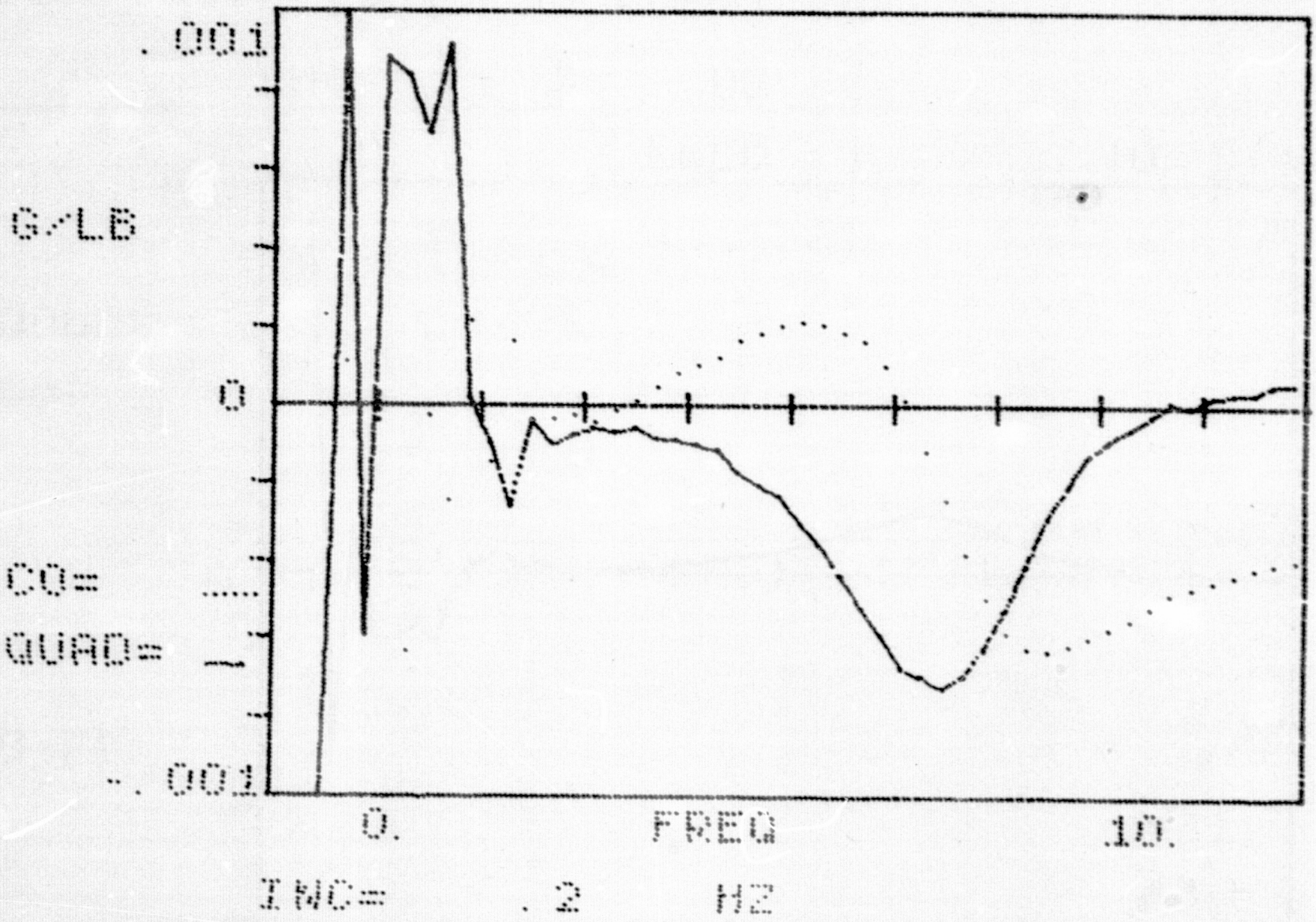
VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH01
DATE = 06DE74

6.75 HZ
MODE

ORIGINAL PAGE IS
OF POOR QUALITY



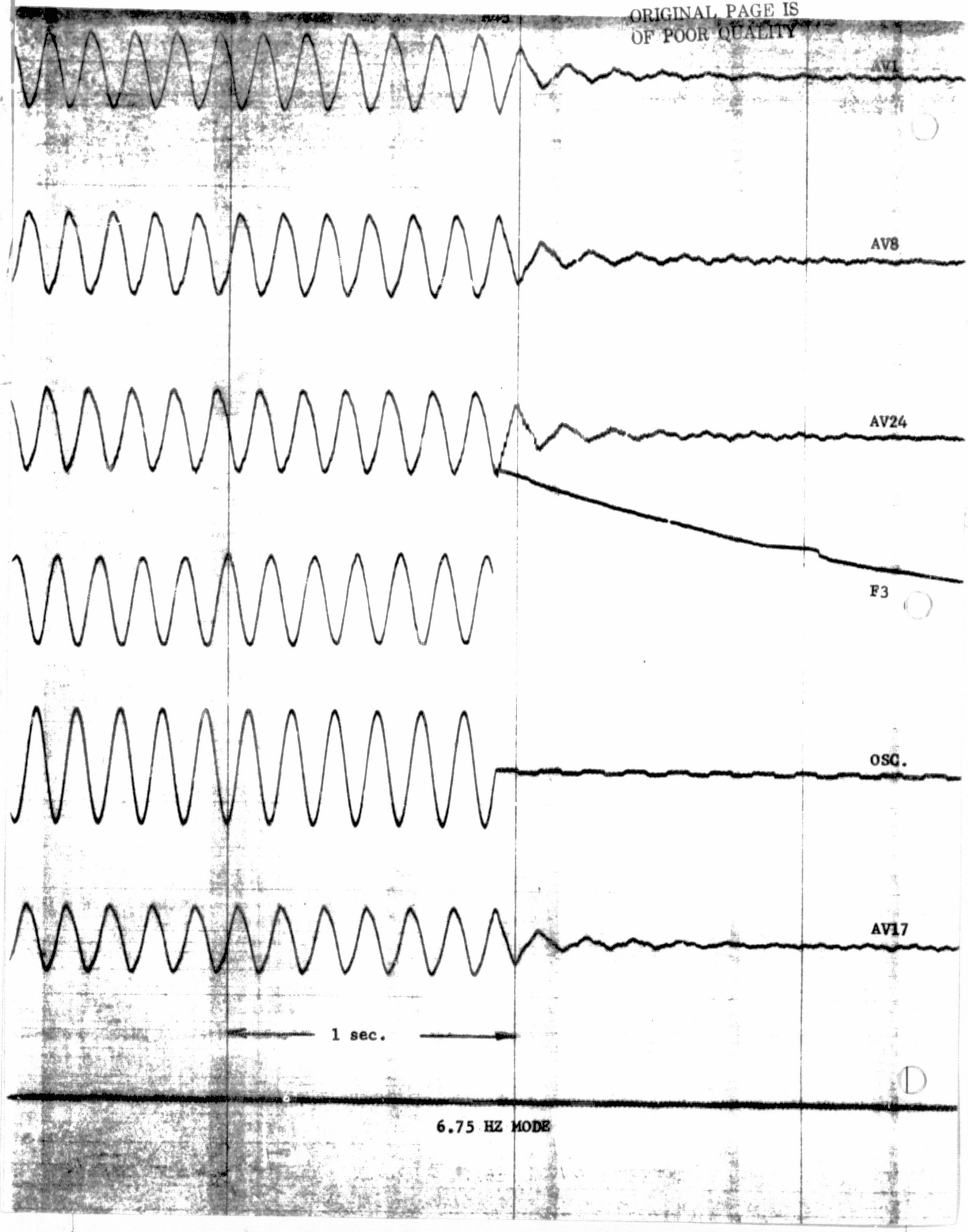
TRK TRAIN 10-21-74 RUN 1 NB
F-3 AV 17

6.75 HZ MODE

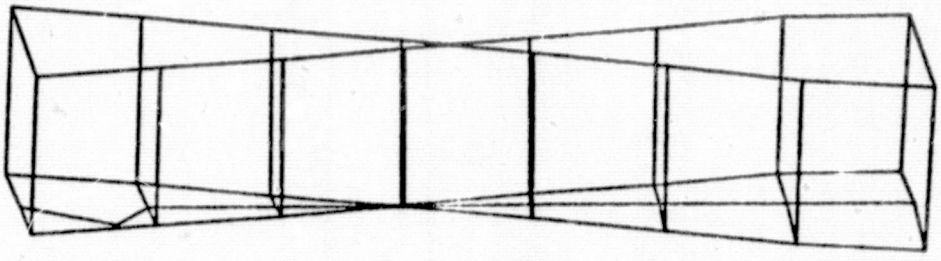
MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	1.4E-04	7.9E-04	AL1/F3	0.0E-04	2.7E-04
AV2	-0.6	-6.7	AL2	0.0	1.1
AV3	-0.2	-4.1	AL3	0.1	1.0
AV4	-0.1	-1.4	AL4	0.0	0.0
AV5	0.0	1.0	AL5	0.0	-0.1
AV6	0.3	3.1	AL6	0.2	-0.7
AV7	0.4	5.8	AL7	-0.1	-2.2
AV8	-1.8	-7.7	AL8	-0.1	-2.4
AV9	-0.5	-0.9	AL9	-0.7	-8.5
AV10	-0.2	-0.7	AL10	-1.2	-9.2
AV11	-0.4	-0.3	AL11	-1.0	-5.8
AV12	-0.2	0.0	AL12	-0.3	-1.3
AV13	-0.3	0.4	AL13	-0.2	1.8
AV14	-0.2	0.7	AL14	0.1	6.6
AV15	-0.3	1.1	AL15	0.2	9.6
AV16	-0.3	1.2	AL16	0.2	9.1
*AV17	-2.0	-6.7	AL17	-0.1	0.7
AV18	0.6	6.1	AL18	0.0	-0.1
AV19	0.3	3.4			
AV20	0.3	1.0			
AV21	0.1	-1.5			
AV22	-0.1	-4.4			
AV23	-0.1	-6.5			
AV24	0.7	8.7			
F1	-1.04	6.116E-02			
F5	-1.007	6.418E-02			
F7	0.9868	6.201E-02			

* Tuning Measurements - AV17, F3 = 79.2 lb-pk

ORIGINAL PAGE IS
OF POOR QUALITY



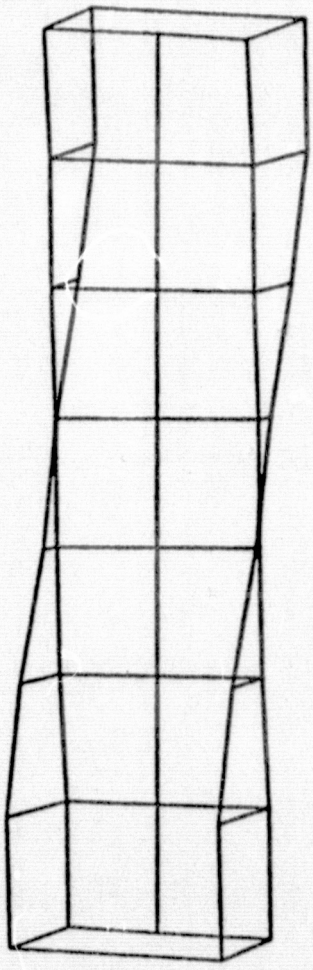
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .3, MODE(1) = 6.75 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-2.00000000E+03	Y = 0.	EYE TO EYE = 3.0 IN
Z = 1.50000000E+02	Z = 0.	
RUN NO. = ORTH01	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .3, MODE(1) = 6.75 HZ

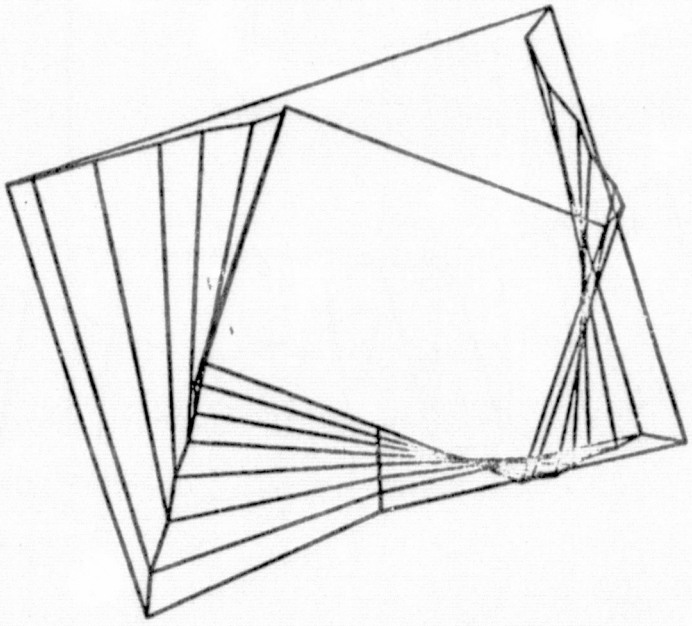
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO1
DATE = 06DE74

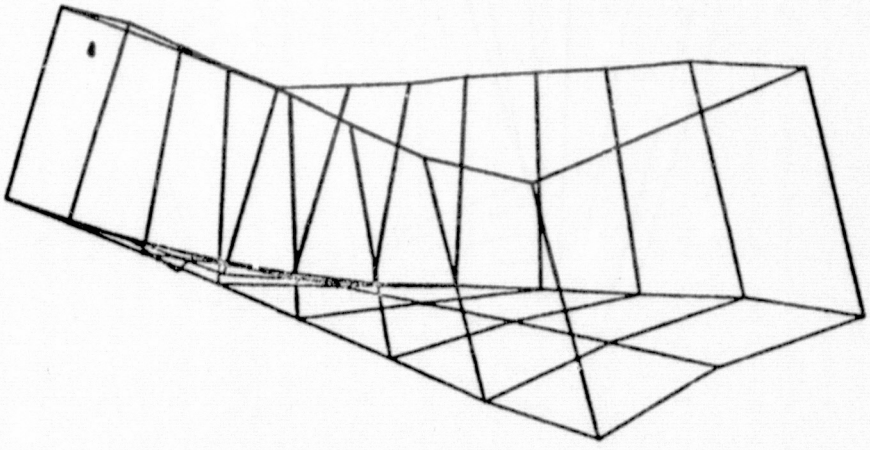
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .3, MODE(1) = 6.75HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTHO1	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .3, MODE(1) = 6.75 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO1
DATE = 06DE74

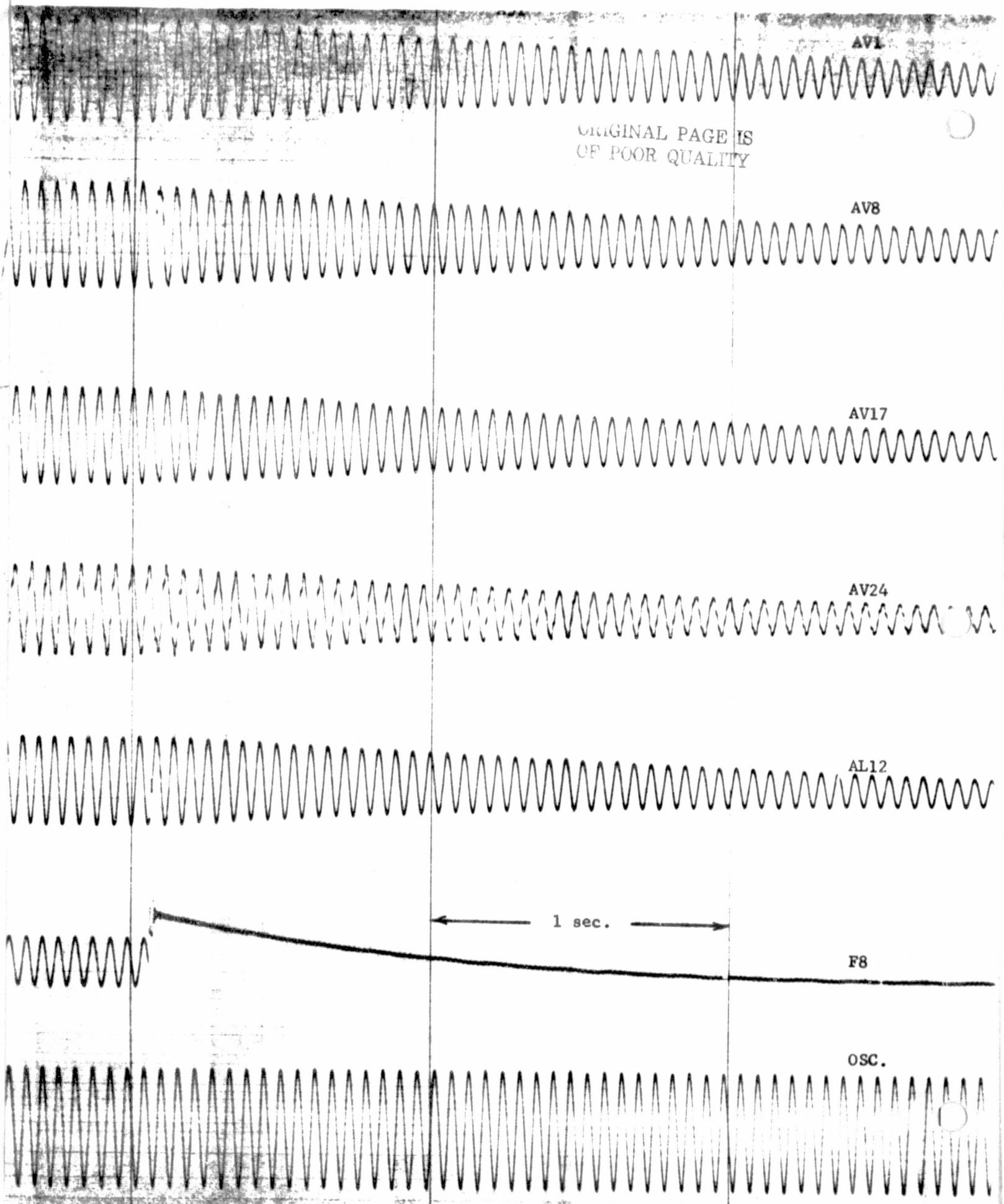
17.64 HZ
MODE

ORIGINAL PAGE IS
OF POOR QUALITY

17.64 HZ MODE

MEAS. NO's.	CO	QUAD	MEAS. NO'S.	CO	QUAD
*AV1/F8	4.4E-04	2.19E-03	AL1/F8	-3.1E-04	-3.12E-03
AV2	1.6	-1.25	AL2	-2.0	-1.45
AV3	-0.8	0.64	AL3	1.0	2.31
AV4	-2.7	1.57	AL4	2.4	3.49
AV5	-2.3	1.95	AL5	1.1	3.41
AV6	-7.3	1.53	AL6	0.0	2.29
AV7	2.4	-0.90	AL7	-0.5	-2.16
AV8	-2.9	2.0	AL8	-0.7	-3.23
AV9	0.0	-0.04	AL9	0.8	-6.03
AV10	-0.2	0.03	AL10	9.4	-7.84
AV11	1.2	-0.28	AL11	1.1	2.90
AV12	0.3	-0.09	AL12	-14.8	19.74
AV13	-0.7	0.06	AL13	-22.4	18.76
AV14	1.1	-0.23	AL14	2.8	-0.82
AV15	-0.3	0.01	AL15	19.8	-11.40
AV16	0.1	-0.06	AL16	11.8	-6.19
AV17	3.0	-1.60	AL17	2.1	-1.22
AV18	0.9	1.11	AL18	-3.2	1.11
AV19	-0.1	-0.33			
AV20	-2.2	-1.82			
AV21	-2.0	-2.13			
AV22	-0.1	-0.36			
AV23	0.1	1.05			
AV24	-5.5	-1.86			
F1/F8	-0.4715	2.0E-03			
F3	0.4733	13.64E-03			
F5	0.4781	-2.52E-03			
F7	-0.47	16.92E-03			
F9	-0.9593	13.58E-03			

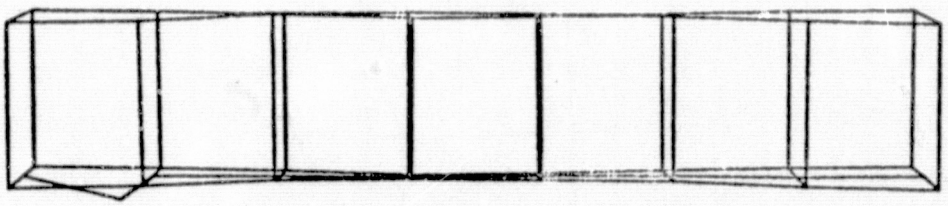
* Tuning Measurements - AV1, F8 = 39.6 lb-pk



ORIGINAL PAGE IS
OF POOR QUALITY

17.64 HZ MODE

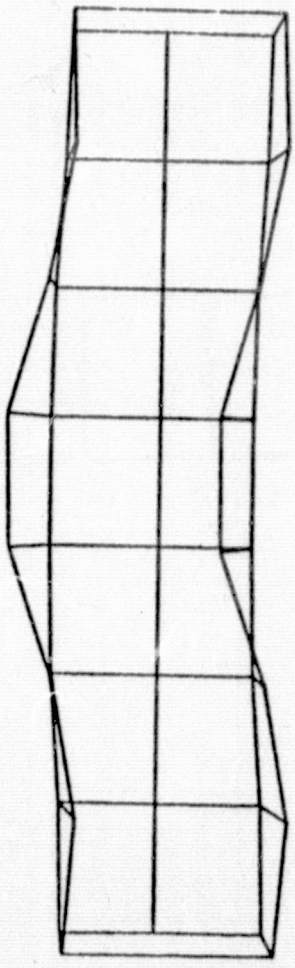
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .0, MODE(2) = 17.64 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-2.00000000E+03	Y = 0.	EYE TO EYE = 3.0 IN
Z = 1.50000000E+02	Z = 0.	
RUN NO. = ORTHO1	DATE = 06DE74	

LEFT EYE VIEW



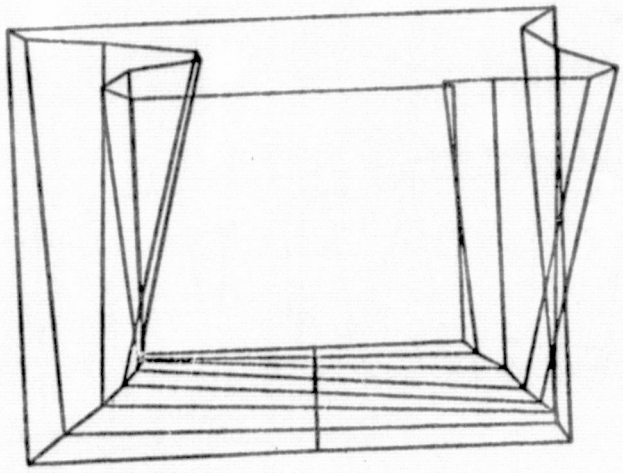
EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .0. MODE(2) = 17.64 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO1
DATE = 06DE74

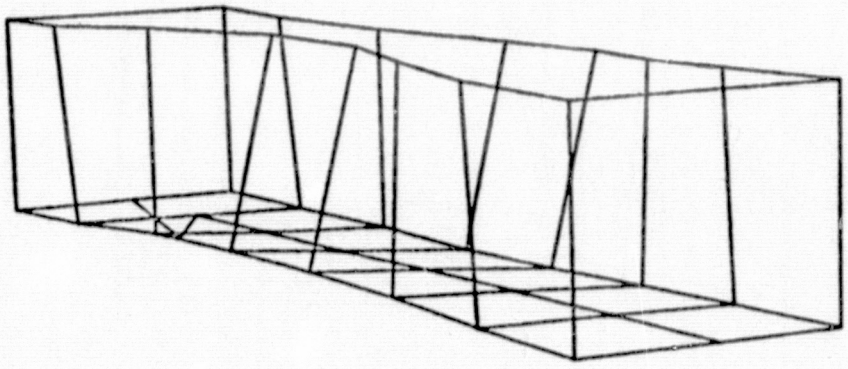


LEFT EYE VIEW

EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .0, MODE(2) = 17.64 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTHO1	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .0, MODE(2) = 17.64 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

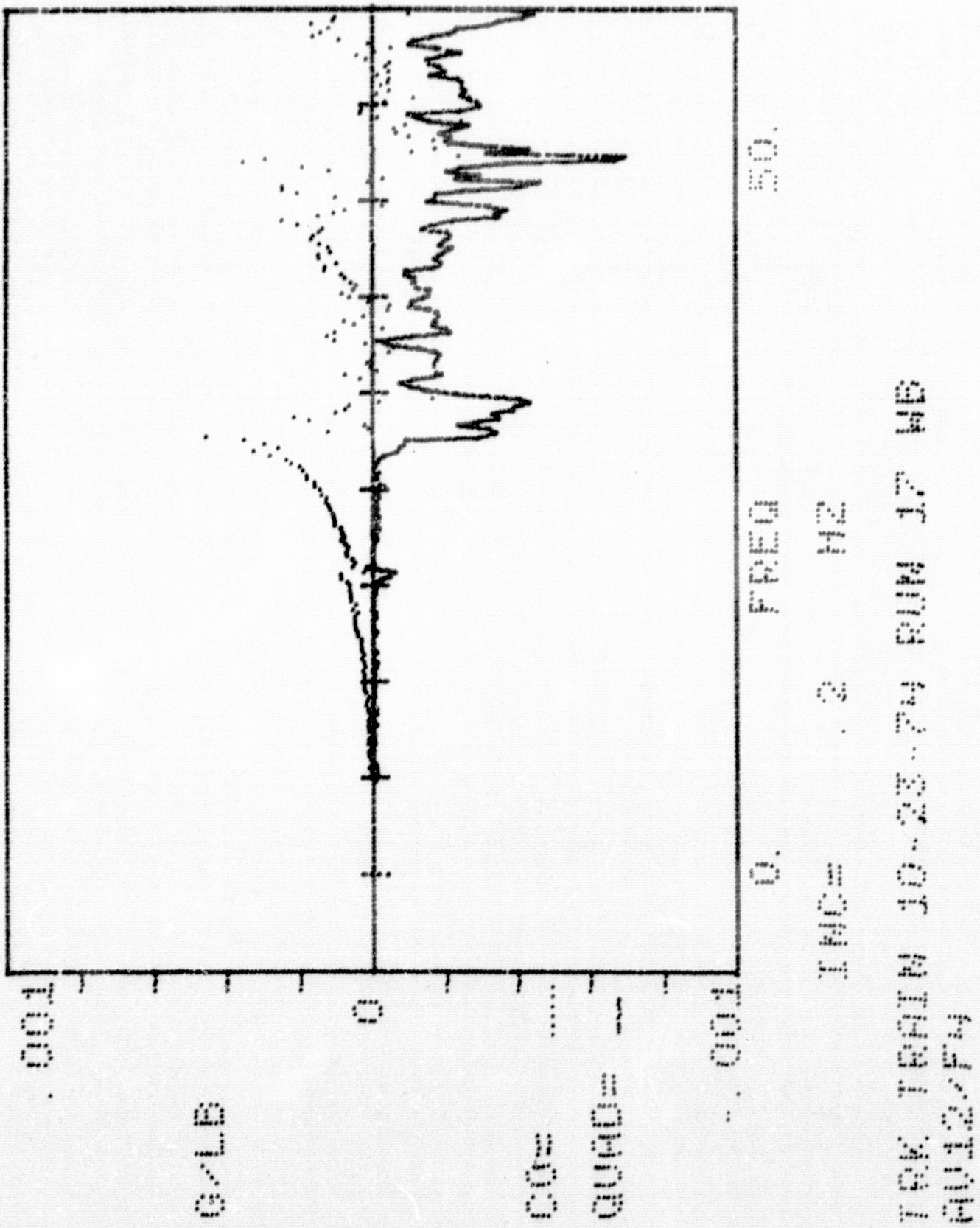
VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

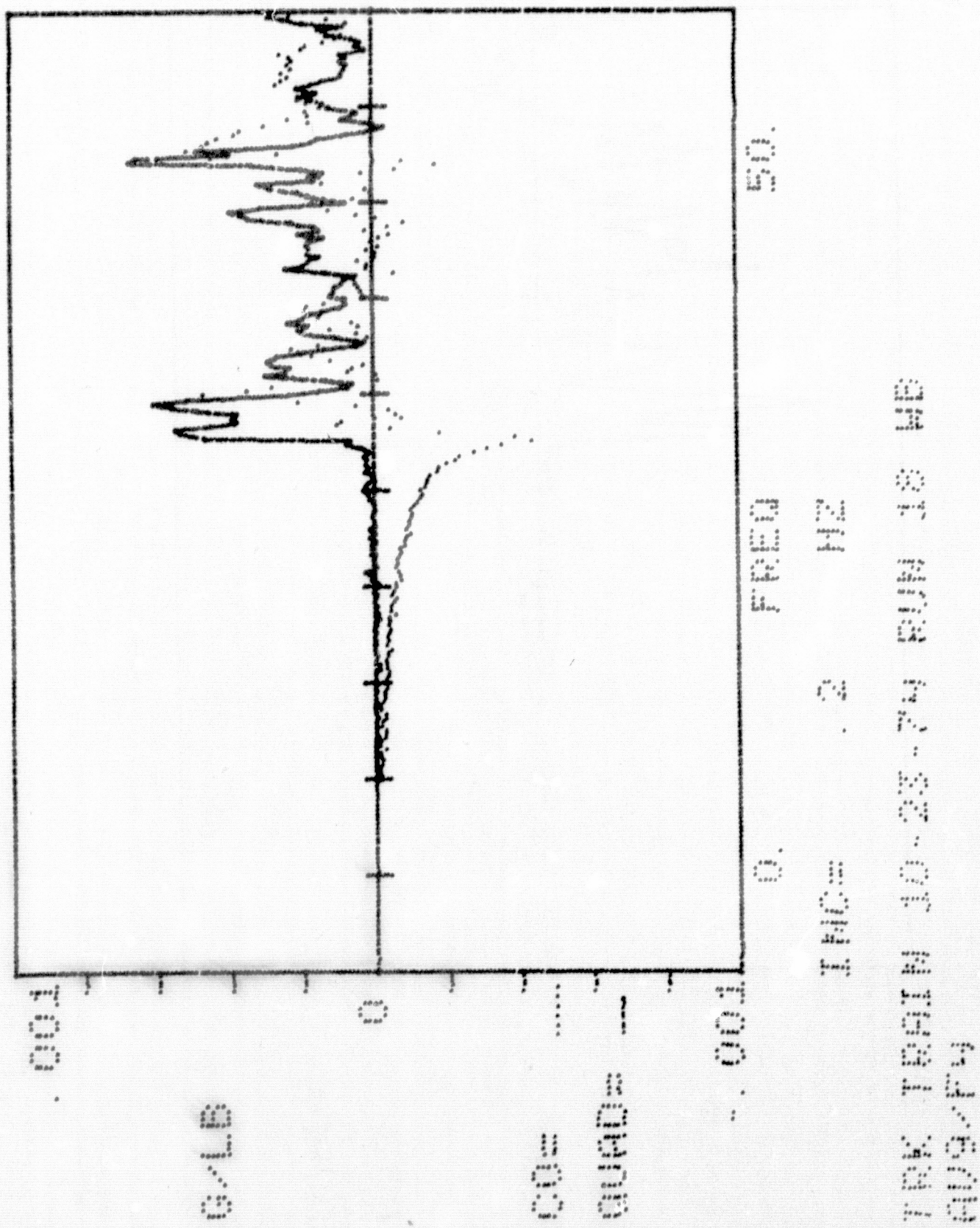
ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

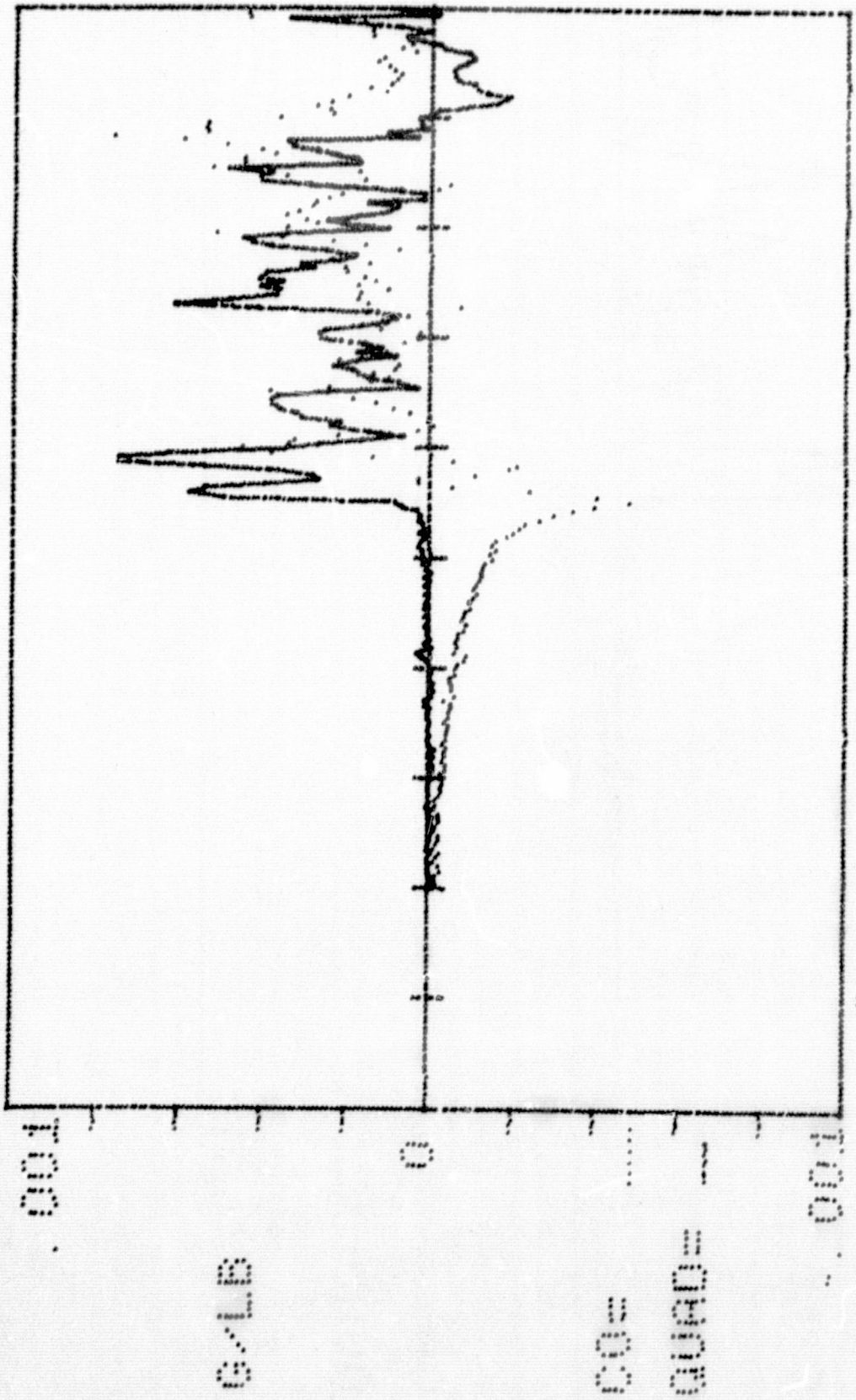
RUN NO. = ORTHO1
DATE = 06DE74

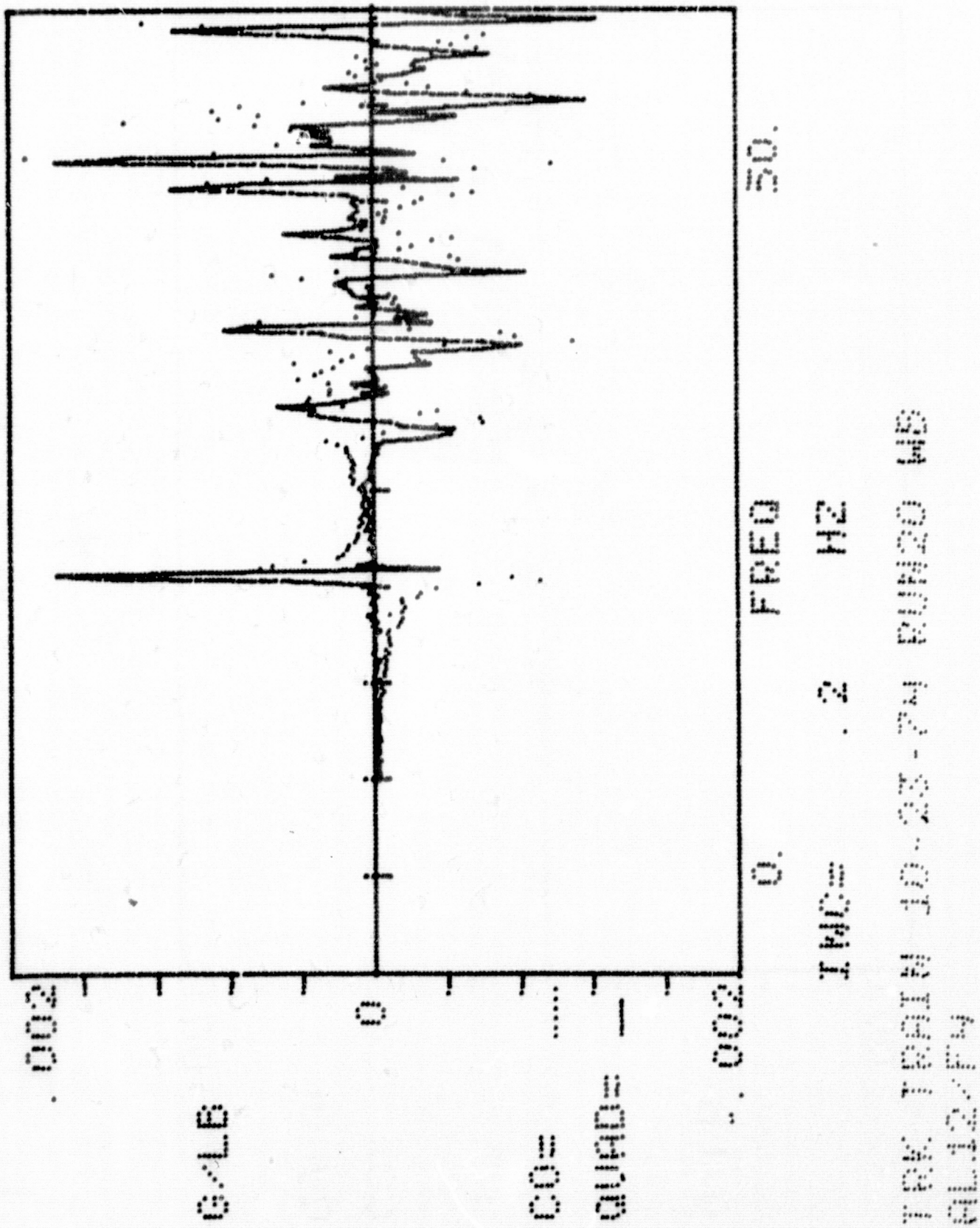
29.57 HZ
MODE

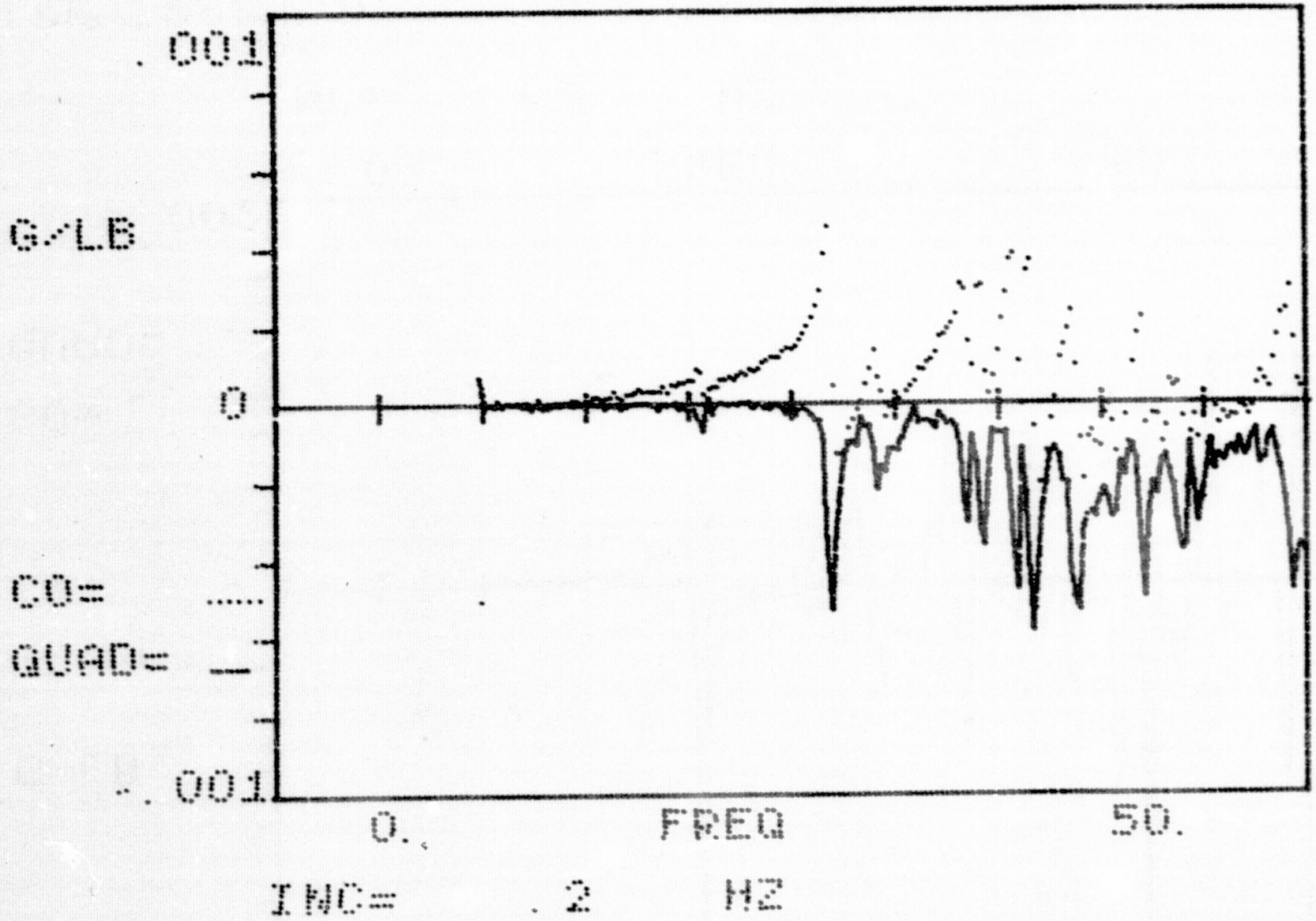
ORIGINAL PAGE IS
OF POOR QUALITY



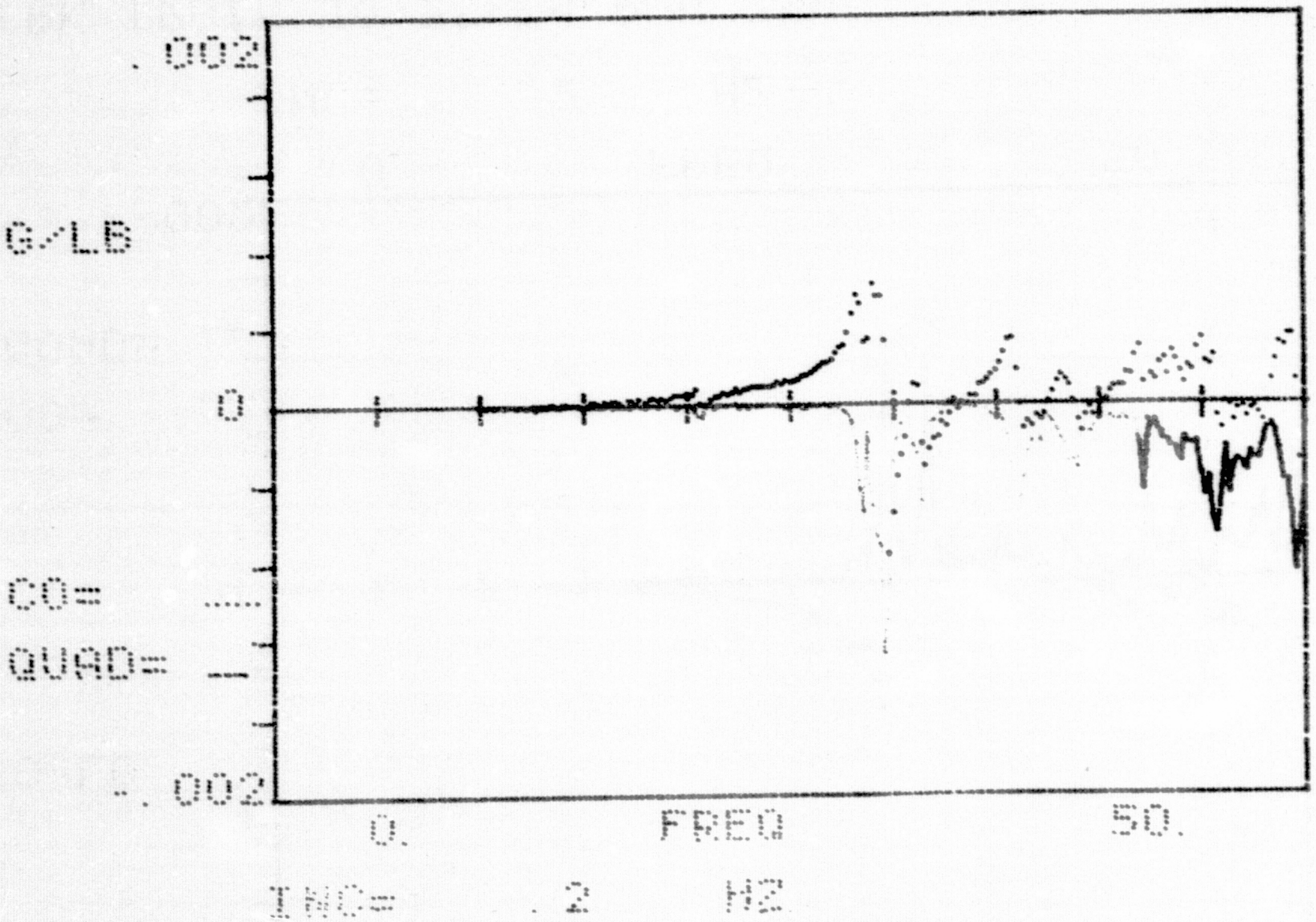




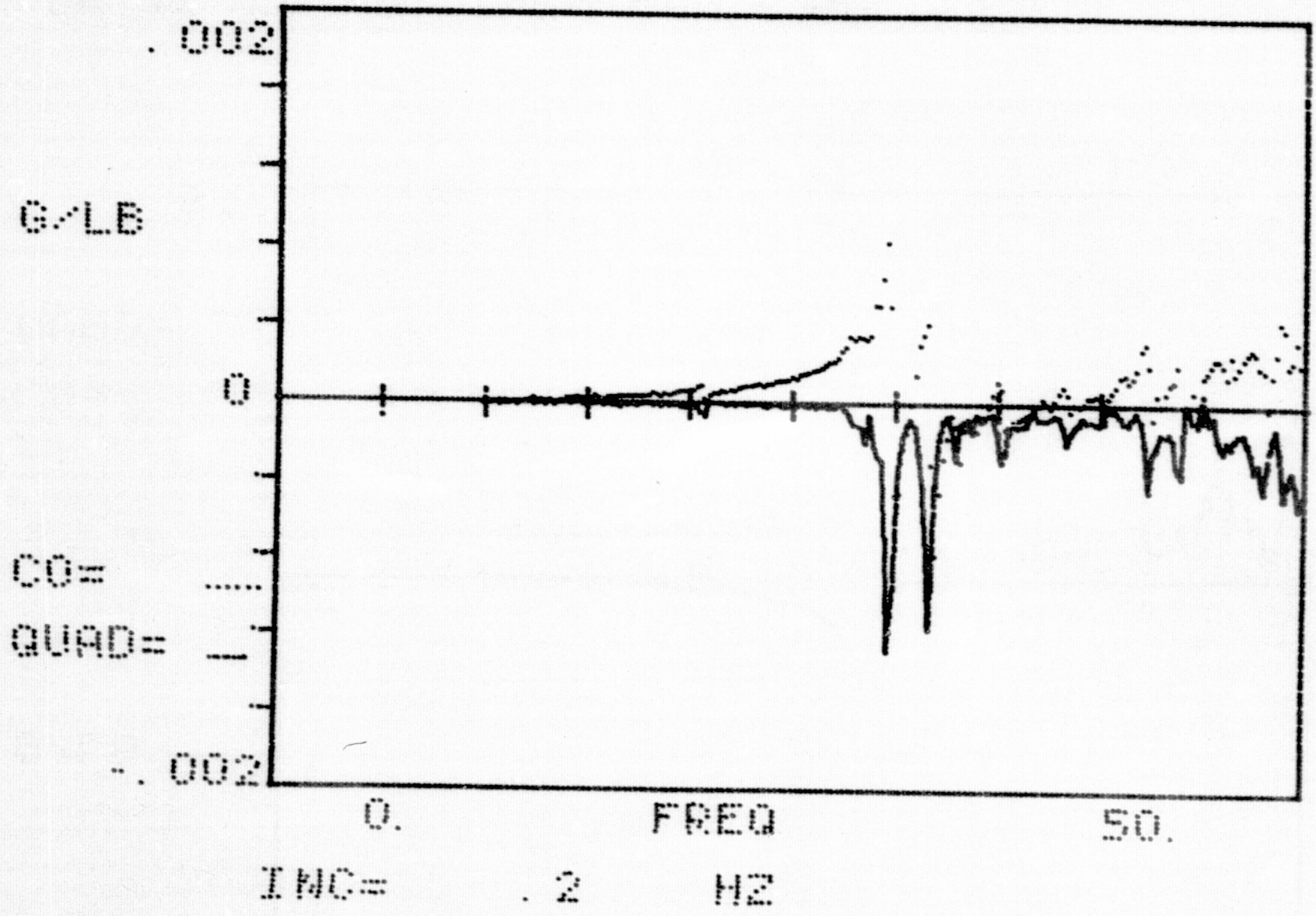

dB
80.
FREQ
0.
TIME 4.2 HZ
dB
80.
0.
-80.
dB/DIV
-80.



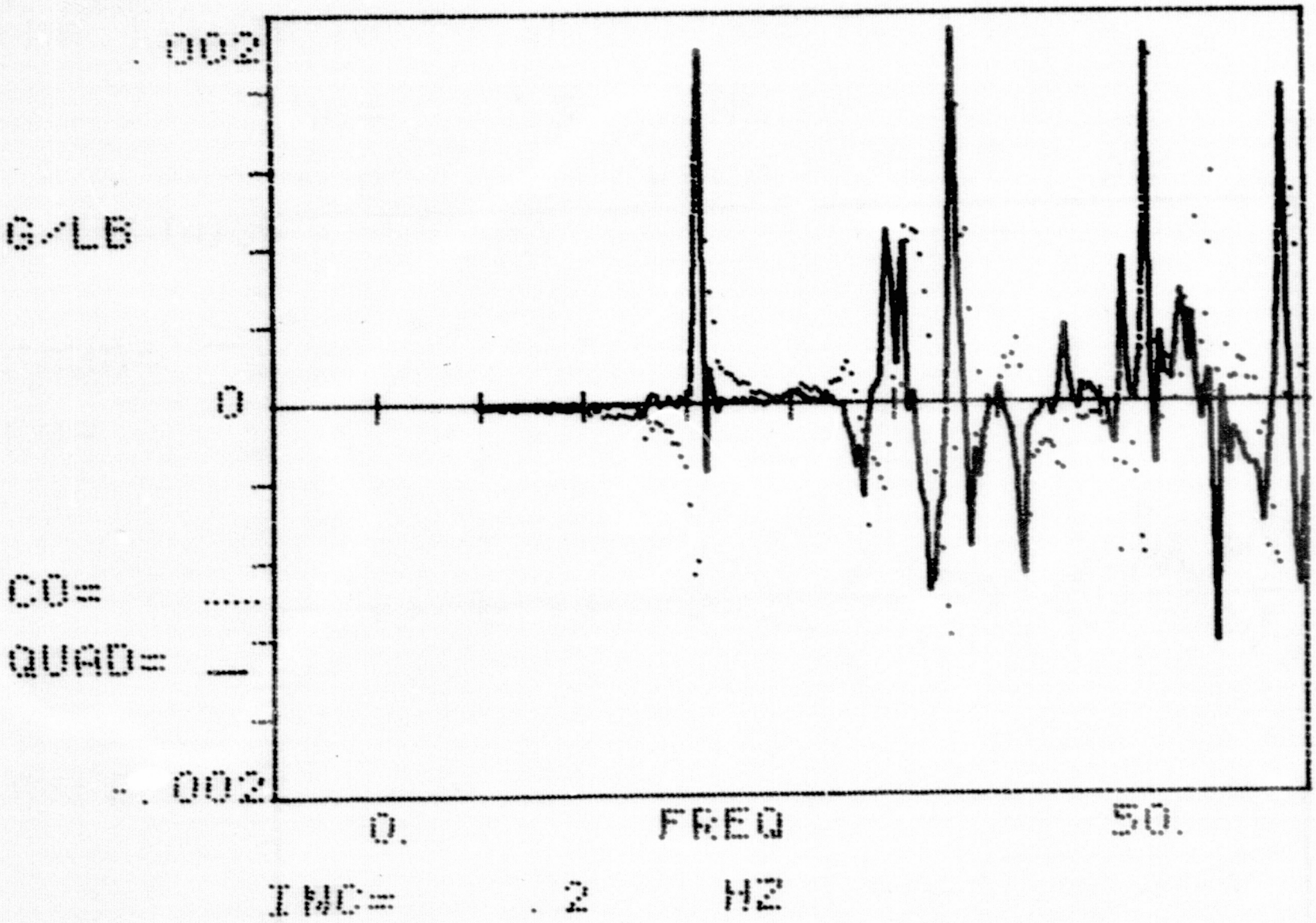
TRK TRAIN 10-23-74 RUN 21 WB
AV12²/F4



TRK TRAIN 10-23-74 RUN 22WB
AV12-F4 (WOOD WEDGES ADDED TO COUPLERS)

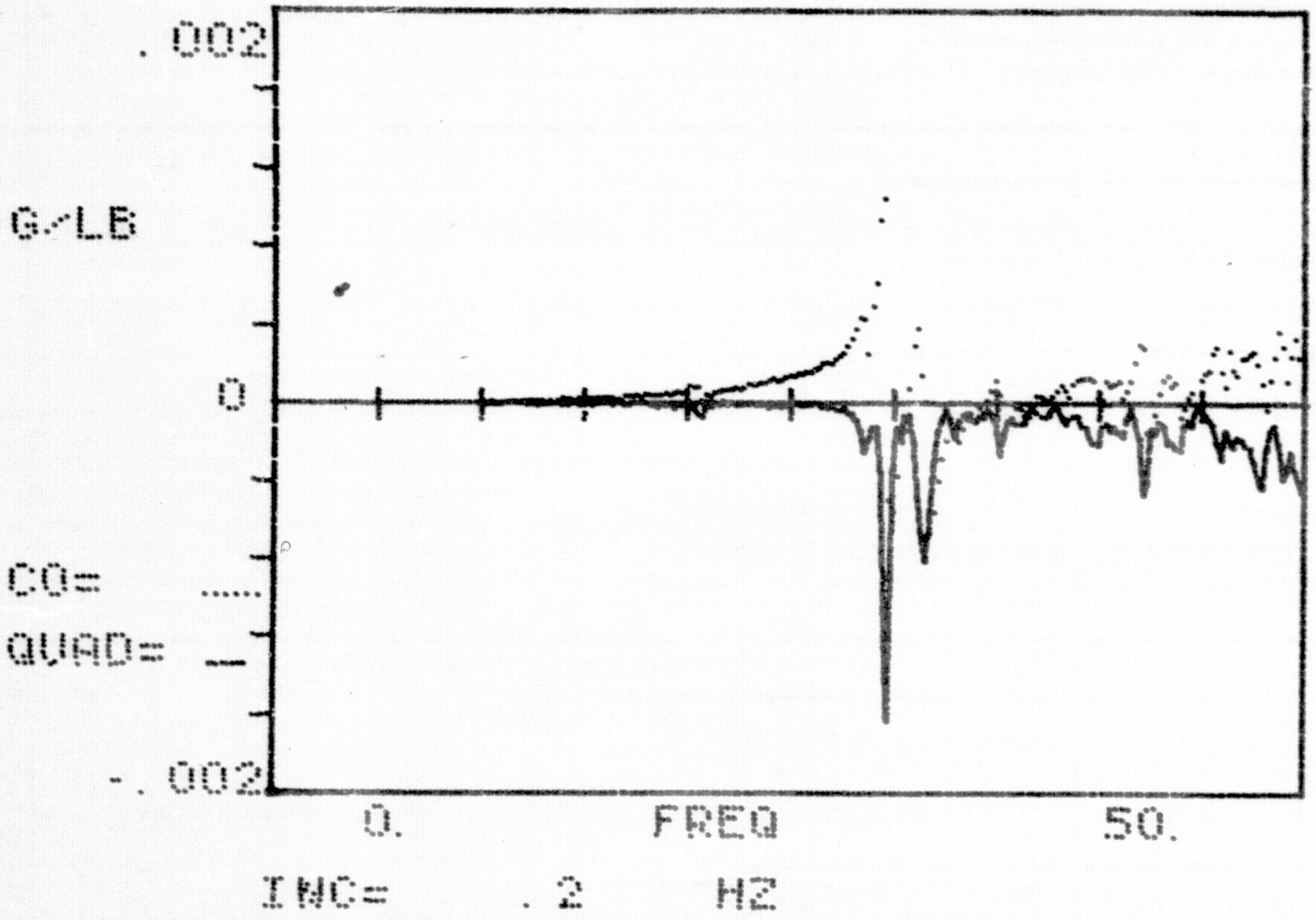


TRK TRAIN 10-23-74 RUN 23WB
AV12/F4 (WOOD WEDGES ADDED TO BRAKE ROD)



TRK TRAIN 10-23-74 RUN 24 WB
AL12/F4

.002
G/LB
0
CO=
QUAD=
-.002
0.
FREQ
50.
INC= .2 HZ
TRK TRAIN 10-24-74 RUN 25 WB
AV12/F4



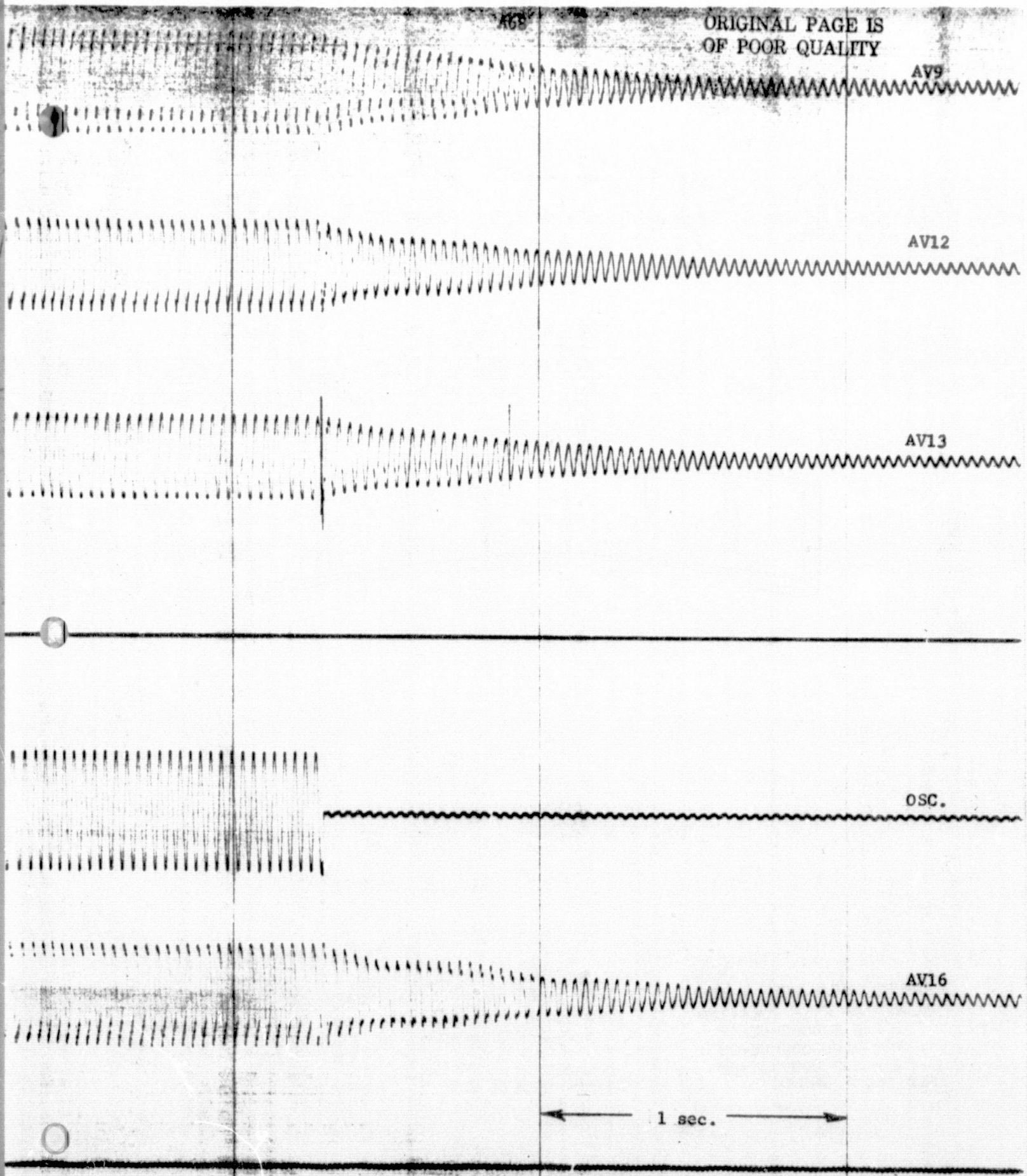
IRK TRAIN 10-24-74 RUN 26 WB
AV12/F4

29.57 HZ MODE

MEAS. NO's.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F4	5.1E-04	1.03E-03	AL1/F4	-0.7E-04	3.1E-04
AV2	-0.1	0.02	AL2	0.0	-3.4
AV3	-0.1	0.78	AL3	0.7	-3.2
AV4	-1.2	1.48	AL4	1.7	-7.9
AV5	-0.4	1.58	AL5	0.9	-1.7
AV6	-0.5	0.55	AL6	0.5	-0.7
AV7	1.4	-0.25	AL7	-0.1	-1.9
AV8	4.3	1.36	AL8	-1.2	3.2
AV9	0.2	2.34	AL9	1.2	-5.3
AV10	-0.4	0.10	AL10	0.0	3.0
AV11	0.9	-1.31	AL11	-4.5	26.9
*AV12	4.8	-1.88	AL12	-3.3	13.9
AV13	4.8	-1.91	AL13	-2.1	8.6
AV14	1.8	-1.21	AL14	-4.3	14.9
AV15	-0.6	0.10	AL15	-2.3	2.3
AV16	-3.8	2.46	AL16	-0.1	-3.8
AV17	3.5	0.77	AL17	0.0	0.8
AV18	-0.2	0.13	AL18	0.5	-5.7
AV19	-2.7	1.13			
AV20	-3.7	1.85			
AV21	-4.3	1.98			
AV22	-3.2	1.31			
AV23	-0.3	0.35			
AV24	0.3	1.04			
F1/F4	-2.444E-01	-2.32E-03			
F3	-2.268E-01	-8.54E-03			
F5	-2.403E-01	-1.03E-03			
F7	-2.382E-01	14.99E-03			

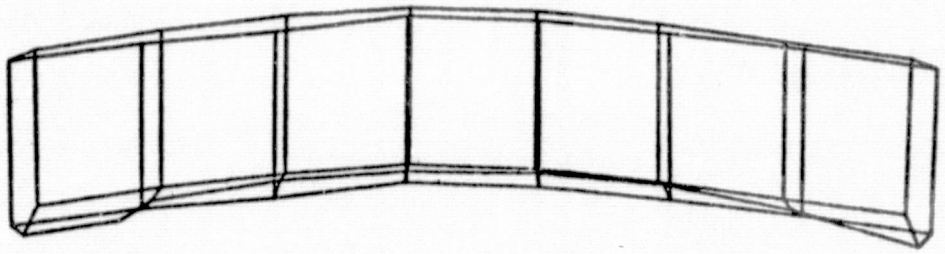
* Tuning Measurements - AV12, F4 = 79.2 lb-pk

ORIGINAL PAGE IS
OF POOR QUALITY



29.57 HZ MODE

LEFT EYE VIEW



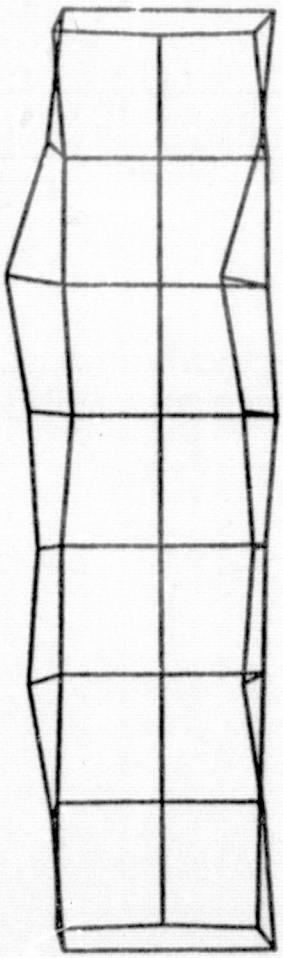
EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .1, MODE(3) = 29.57 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02
RUN NO. = ORTHO1

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.
DATE = 06DEC74

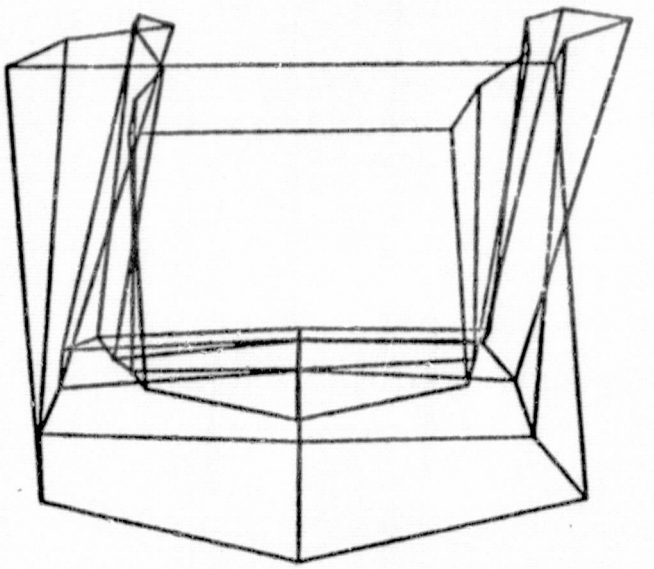
ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .1, MODE(3) = 29.57 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 2.03000000E+02	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 2.00000000E+03	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTHO1	DATE = 06DE74	



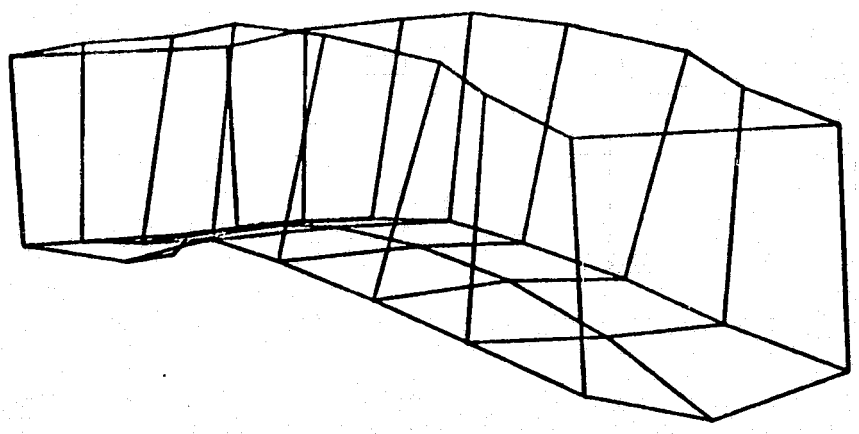
LEFT EYE VIEW

EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .1, MODE(3) = 29.57 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTHO1	DATE = 06DE74	

C-2

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,EMPTY TEST CAR MF = .1, MODE(3) = 29.57 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO1
DATE = 06DE74

APPENDIX B

Configuration 2, Car Full

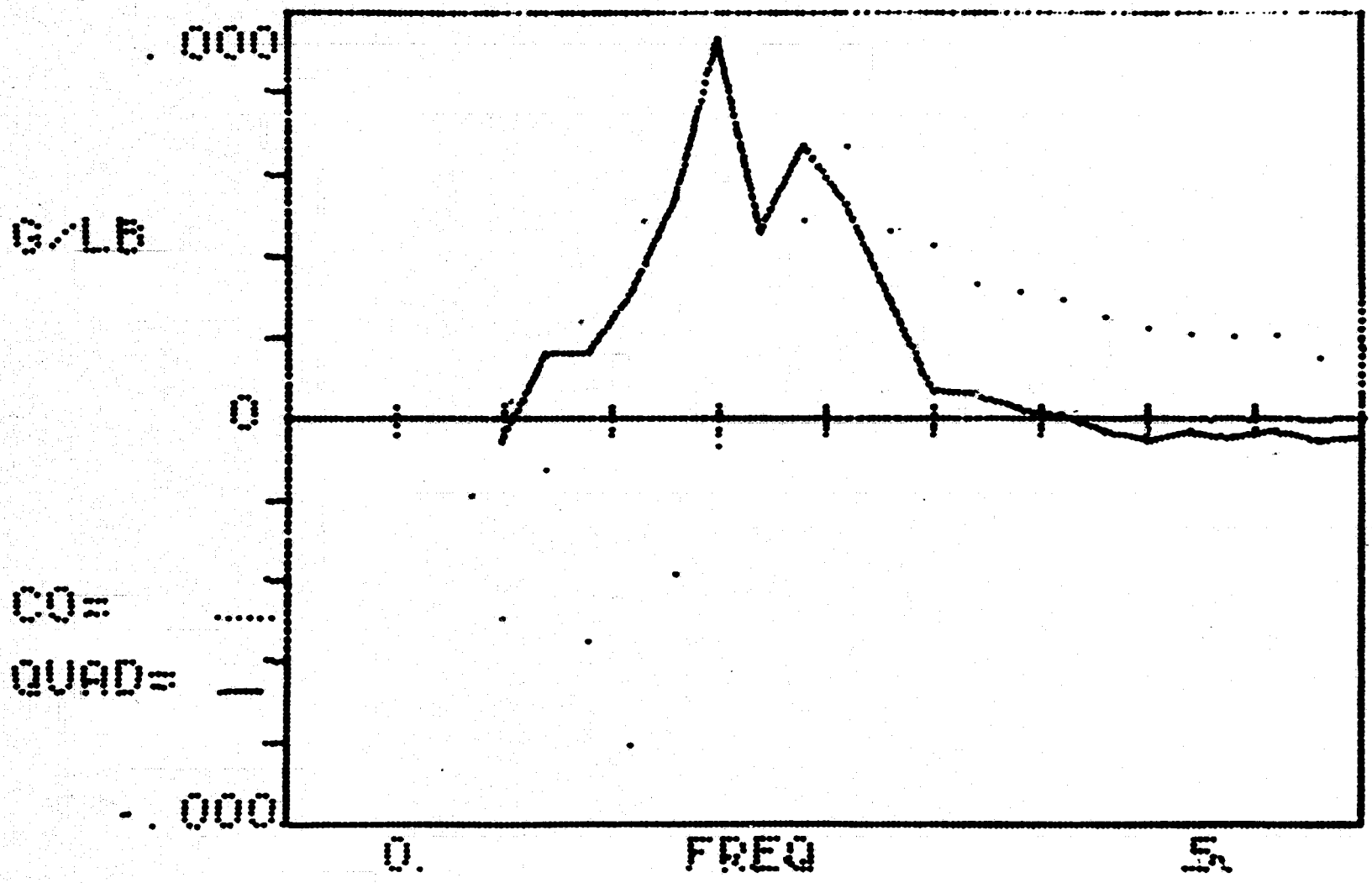
Test Data

2.15 HZ
MODE

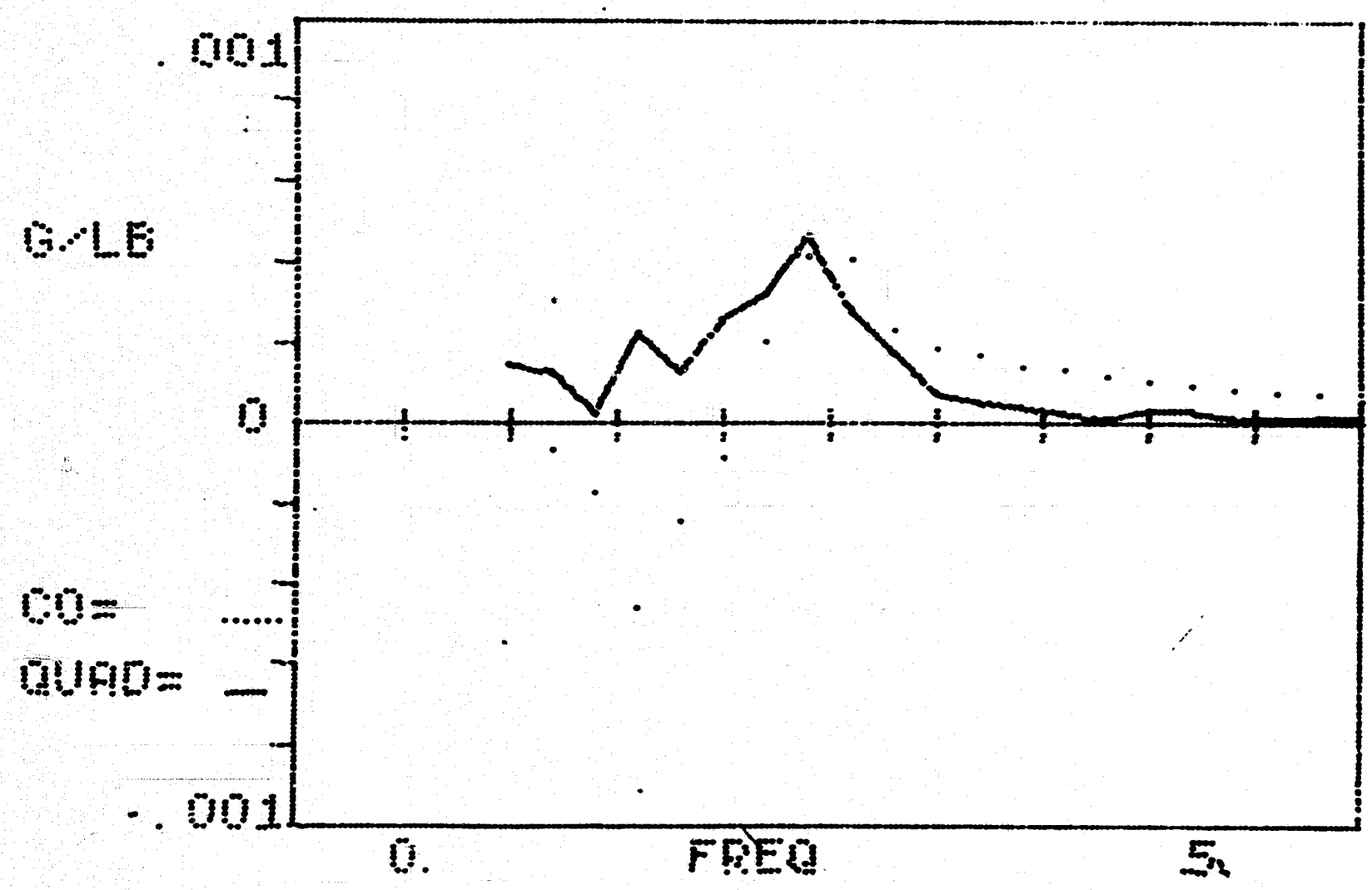
TRK IRM 11-11-74 RUN 32.WB
AV12/F3

ORIGINAL PAGE IS
OF POOR QUALITY

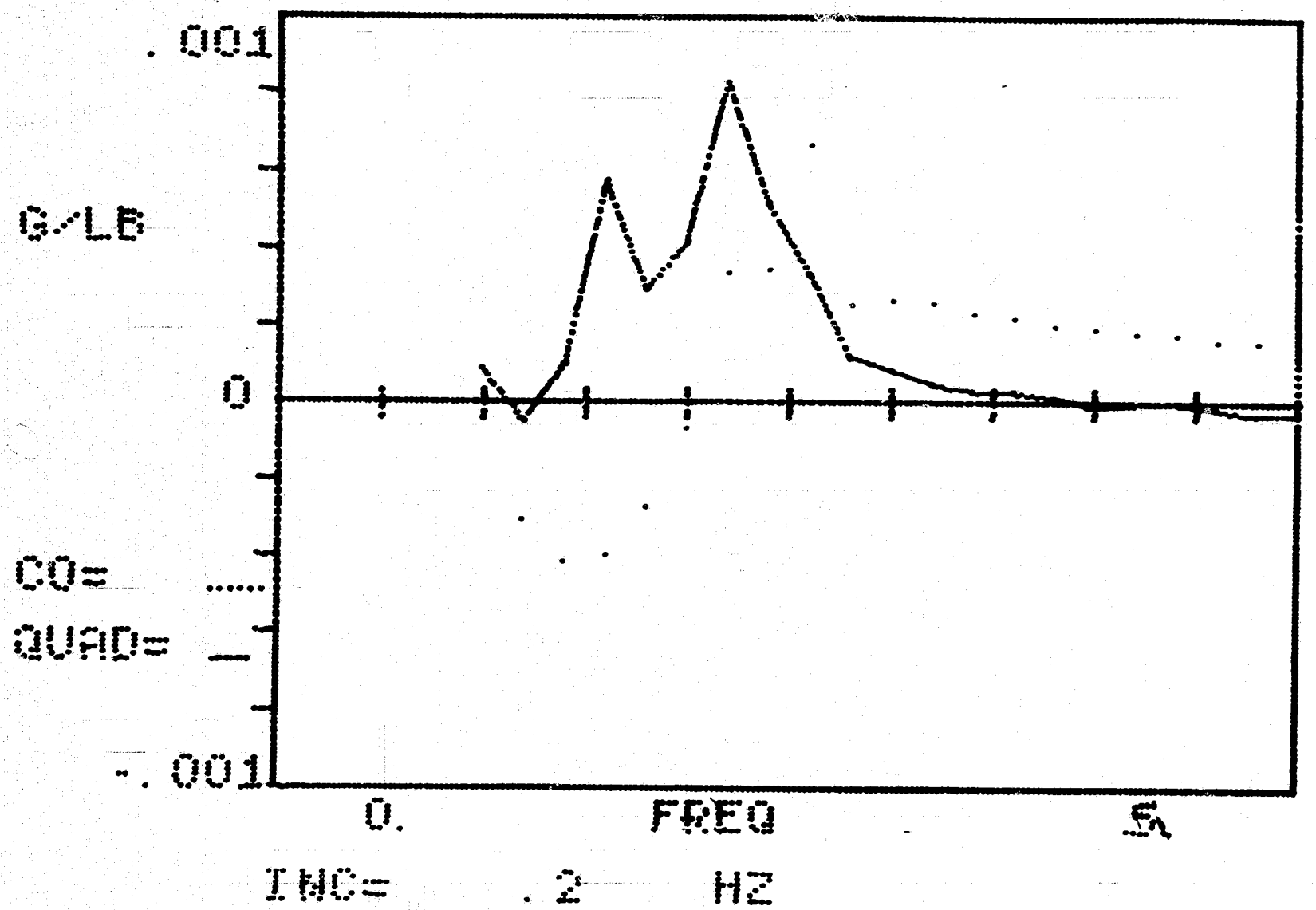
TEK IRN 11-11-74 RUN 14, NB
RUN/F3



TRK IRN 11-11-74 RUN 14 WB
AV17/F3

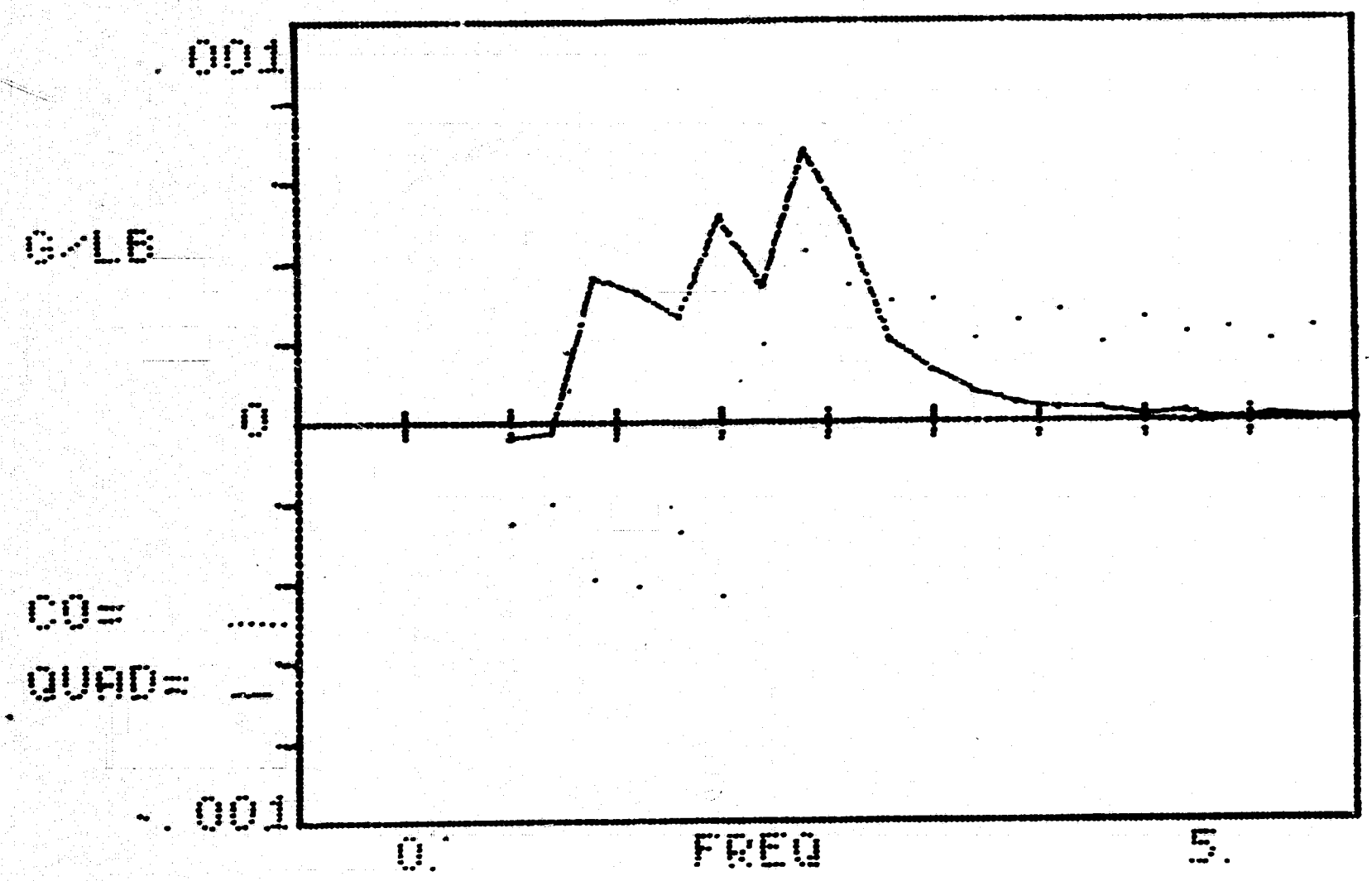


TRK TRN 11-11-74 RUN 15 MB
AU1-F3



TAK IRM 11-11-74 RUN 16 NB
AUB-F3

TRK TRW 11-11-74 RUN 17 NB
AU24-F3



16M 11-11-74 RUN 18 MB

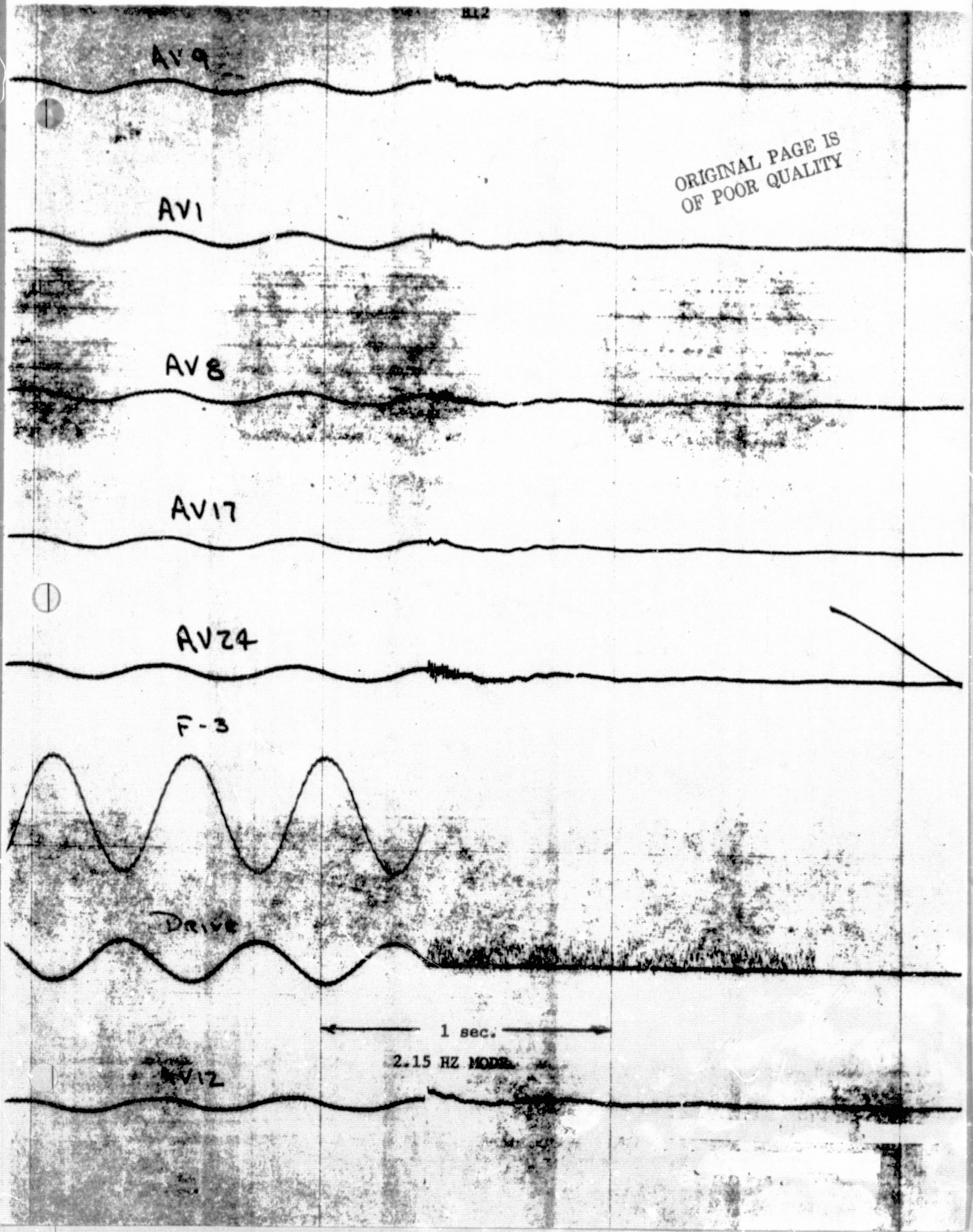
AVIA-F3

B11

2.15 HZ MODE

MEAS. NOS.	CO	QUAD			
AV1/F3	-0.8E-04	7.1E-04			
AV8	2.9E-04	5.1E-04			
*AV12	-2.1E-04	7.3E-04			
AV17	-0.3	5.8E-04			
AV24	-0.6	5.1E-04			
F1					

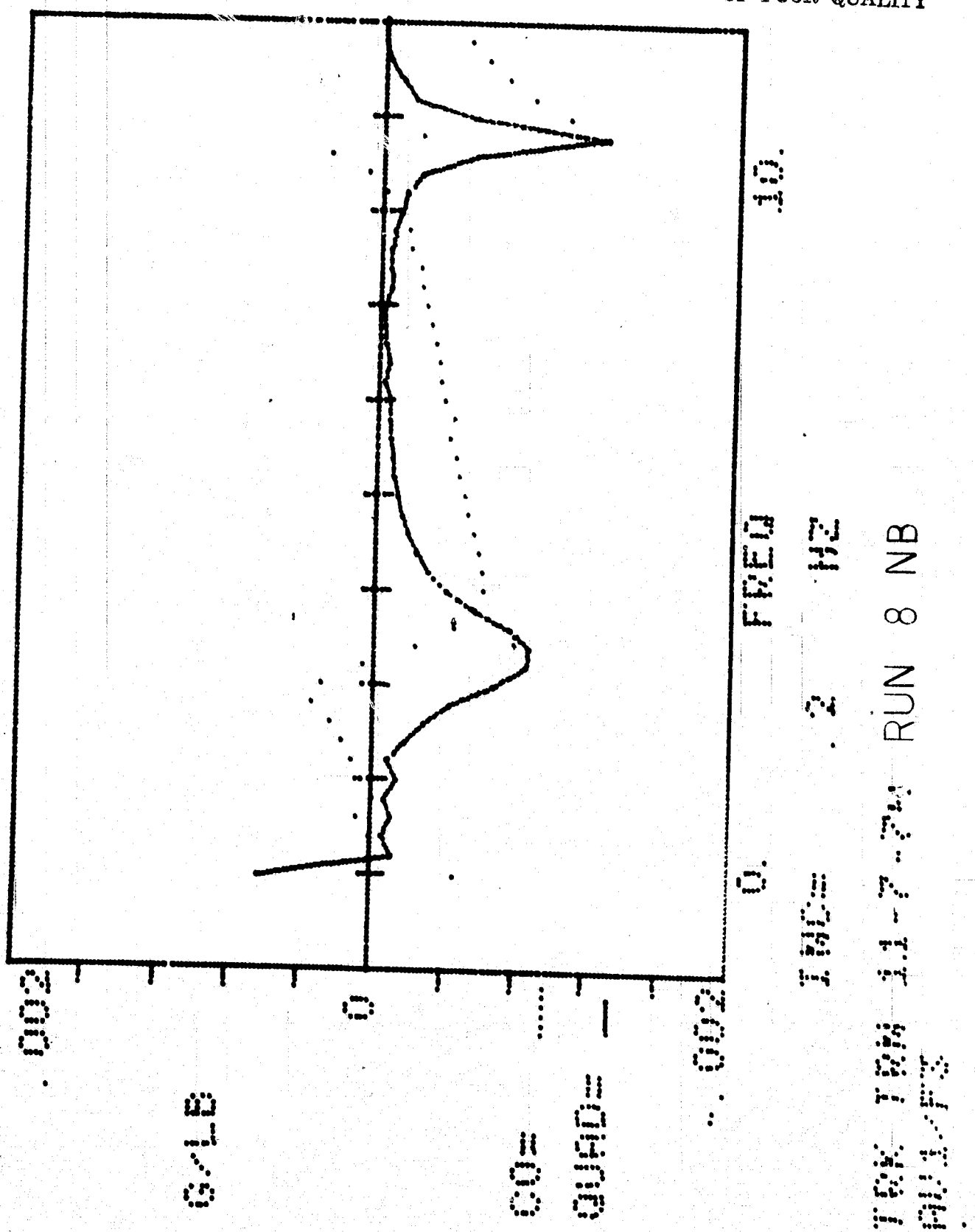
*Tuning Measurements - AV12, F3 = 141 lb-pk

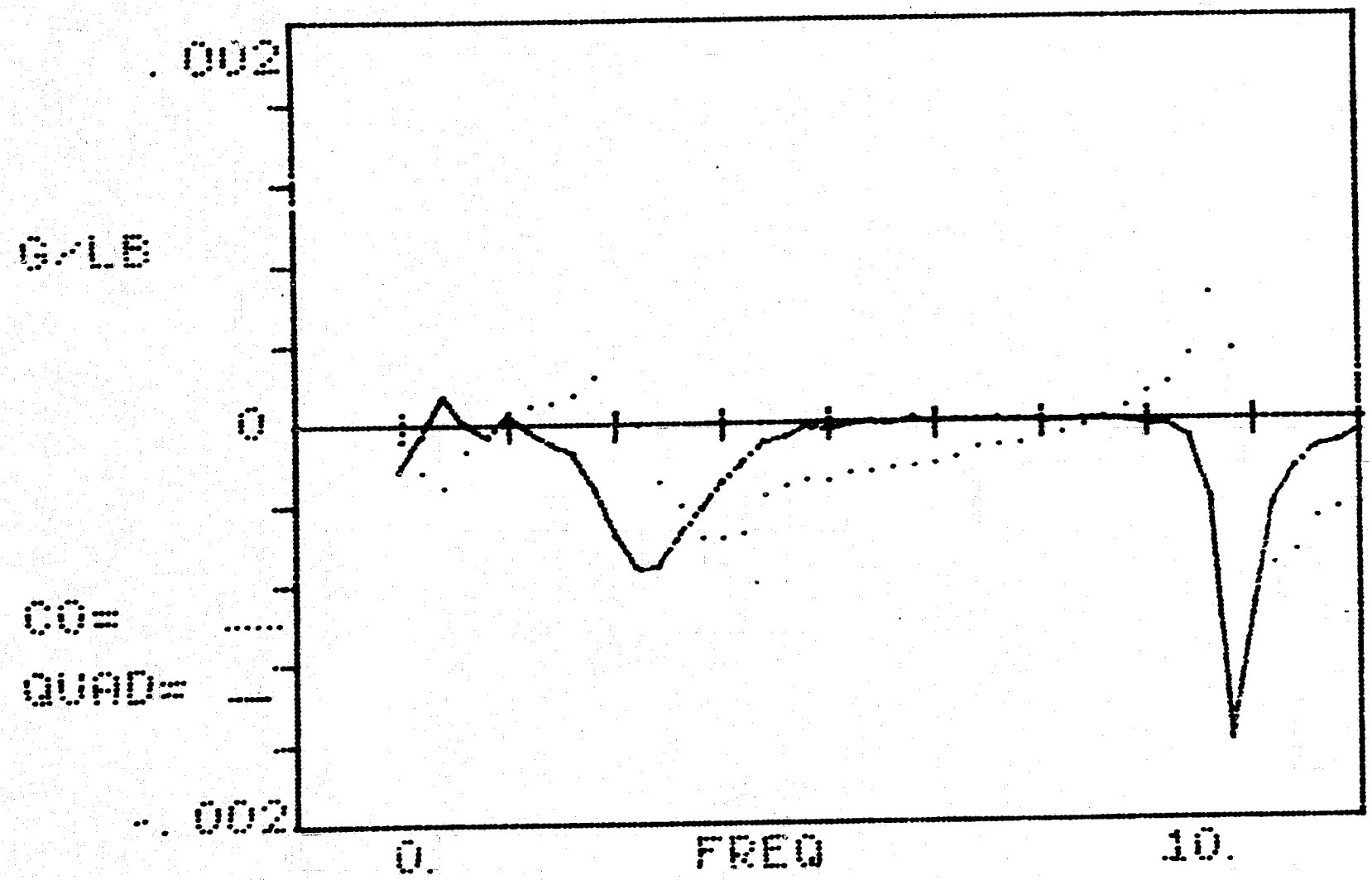


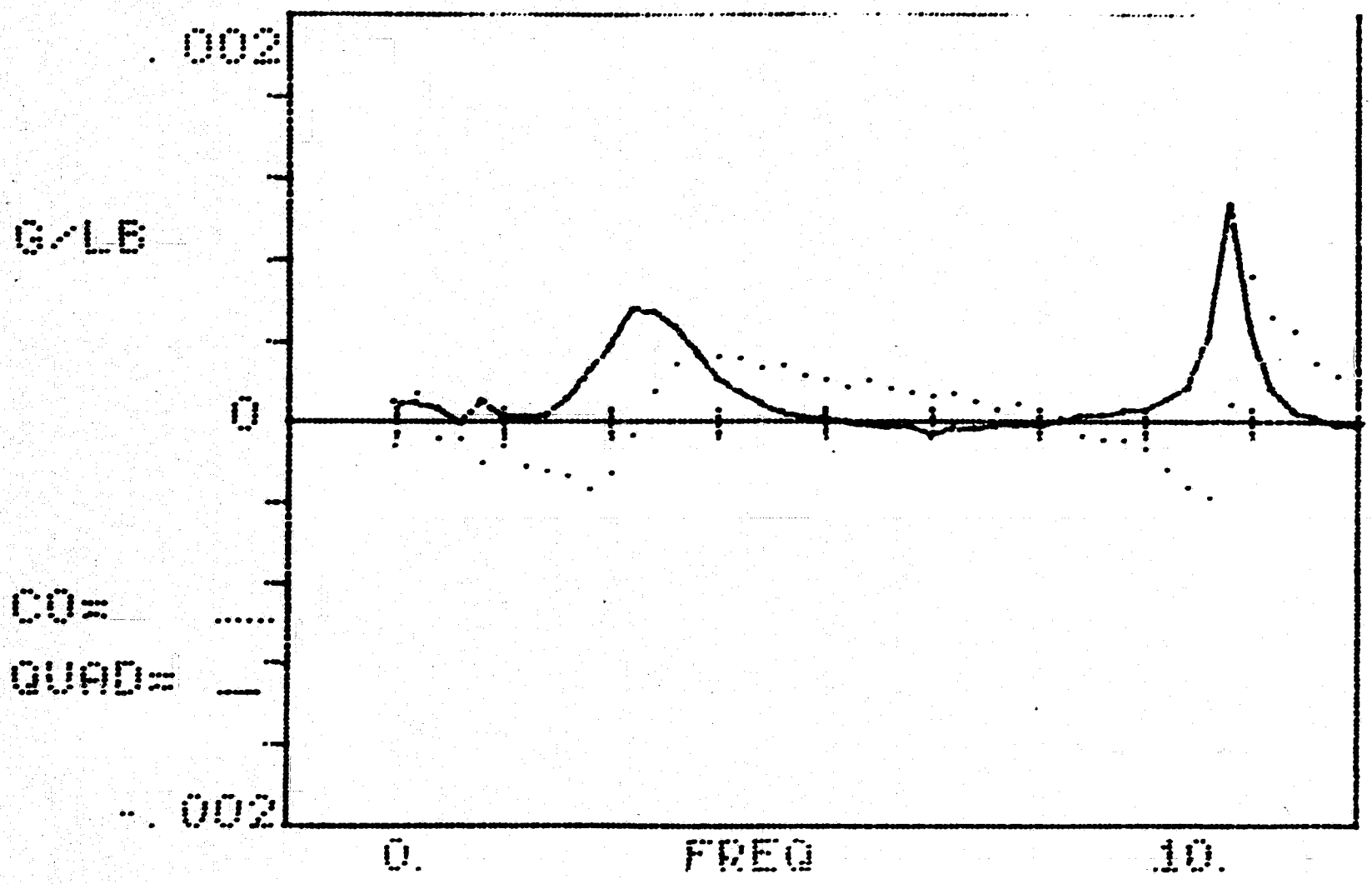
ORIGINAL PAGE IS
OF POOR QUALITY

3.3 HZ
MODE

ORIGINAL PAGE IS
OF POOR QUALITY




.002
G/LB
0
CO=
QUAD=
-.002
0.
FREQ
10.
INC= .2 HZ
TRK TBM 11-7-74 RUN 9 NB
AVG-F3



IMO= .2 HZ

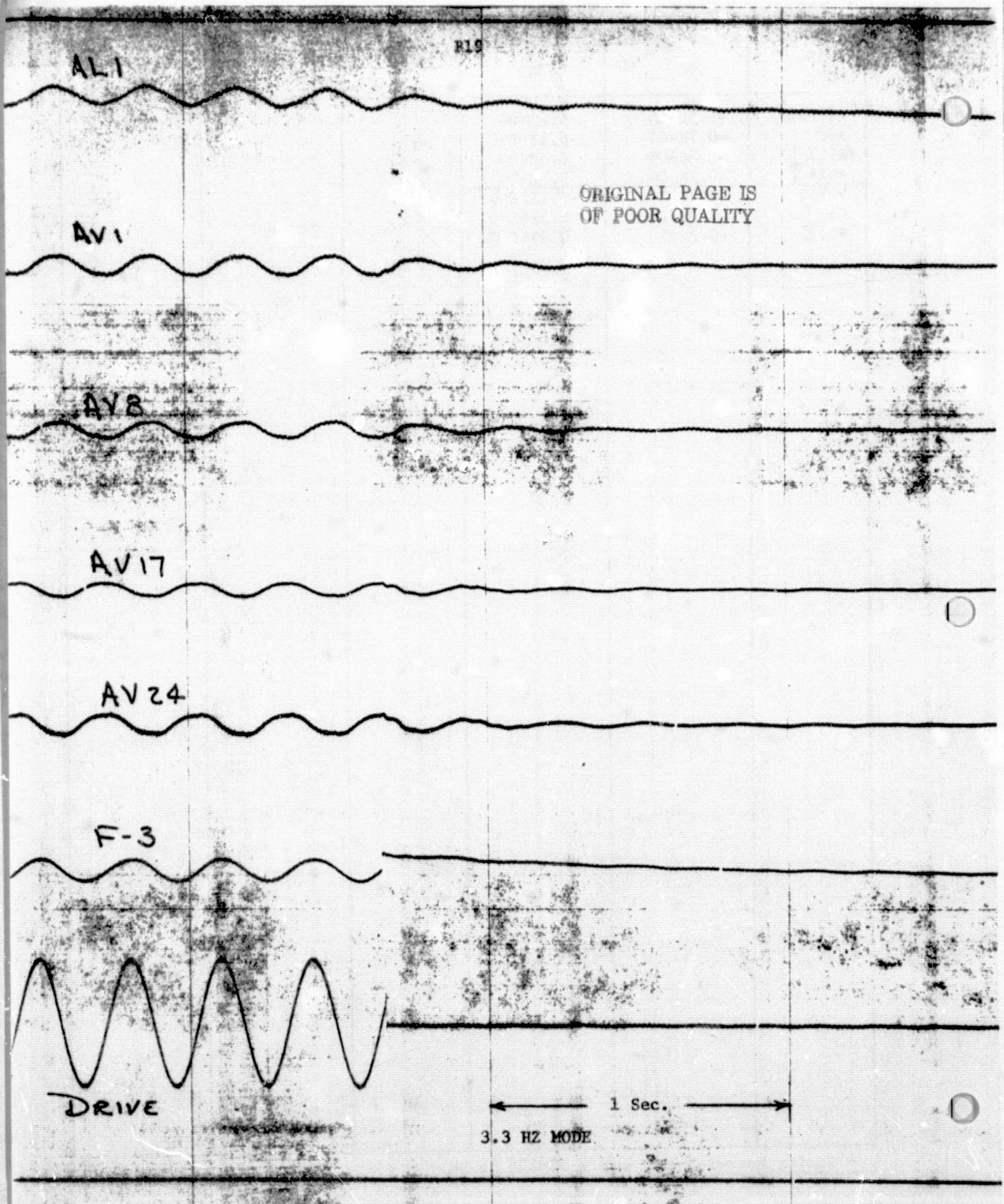
TRK TRM 11-7-74 RUN 10 MB
AU17-F3

.002
G/LB
0
CO=
QUAD=
-.002
0.
FREQ
10.
INC= .2 HZ
TRK TRM 11-7-74 RUN 11 MB
AV24 P3

3.3 HZ MODE

MEAS. NOS.	CO	QUAD			
AV1/F3	-1.5E-04	-9.2E-04			
AV8	-0.7E-04	-6.1E-04			
*AV17	-0.5E-04	6.0E-04			
AV24	-0.7E-04	9.5E-04			
F1/F3	-0.8922	-5.172E-02			
F5	0.9977	5.524E-02			
F7	-0.9429	0.844E-02			

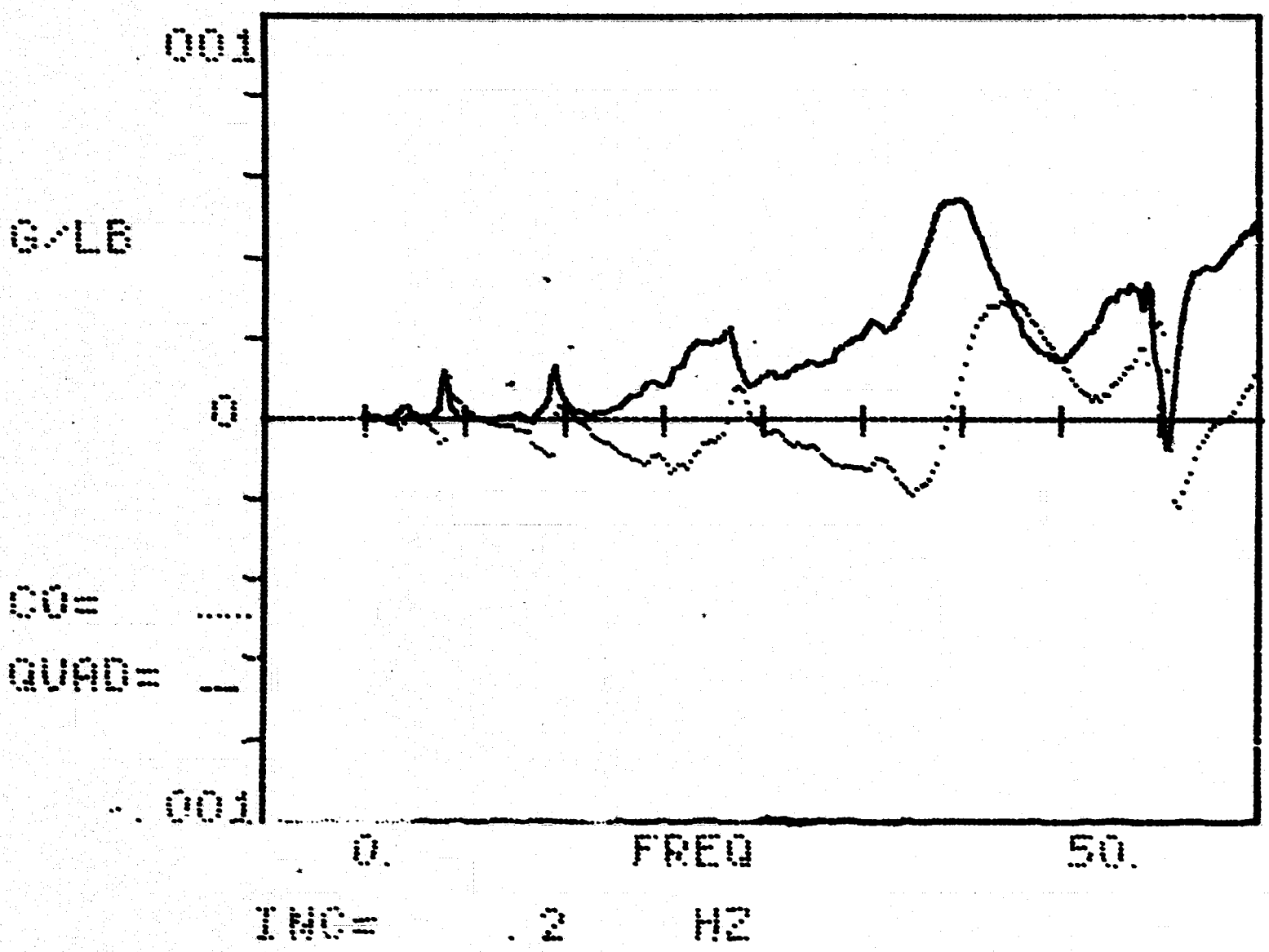
* Tuning Measurements -AV17, F3=156 lb-pk



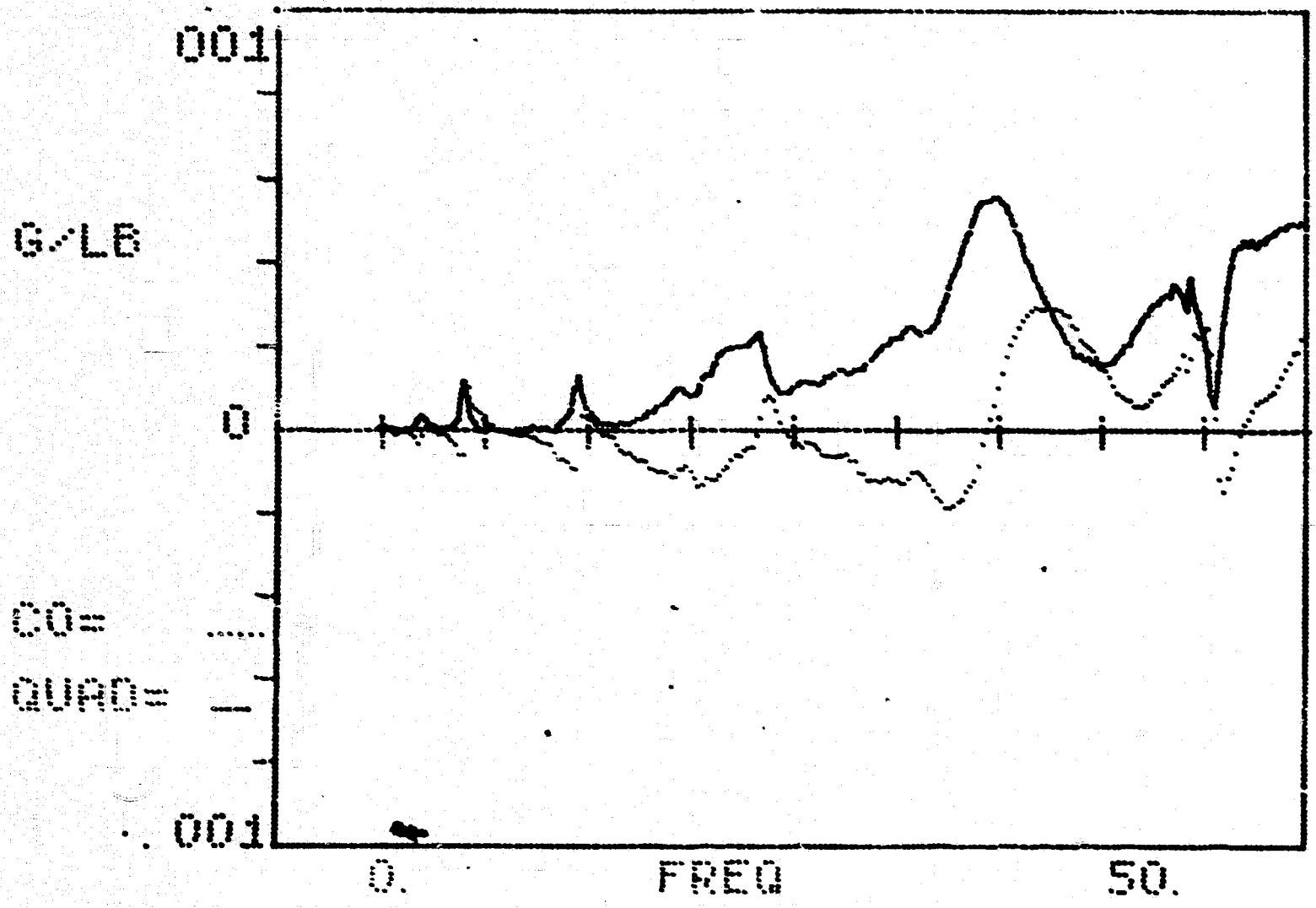
ORIGINAL PAGE IS
OF POOR QUALITY

6.3 HZ
MODE

.000
G-LB
0
DB=
QUAD=
-.000
0.
FREQ
5.
INC= .2 HZ
AV 11-4-74

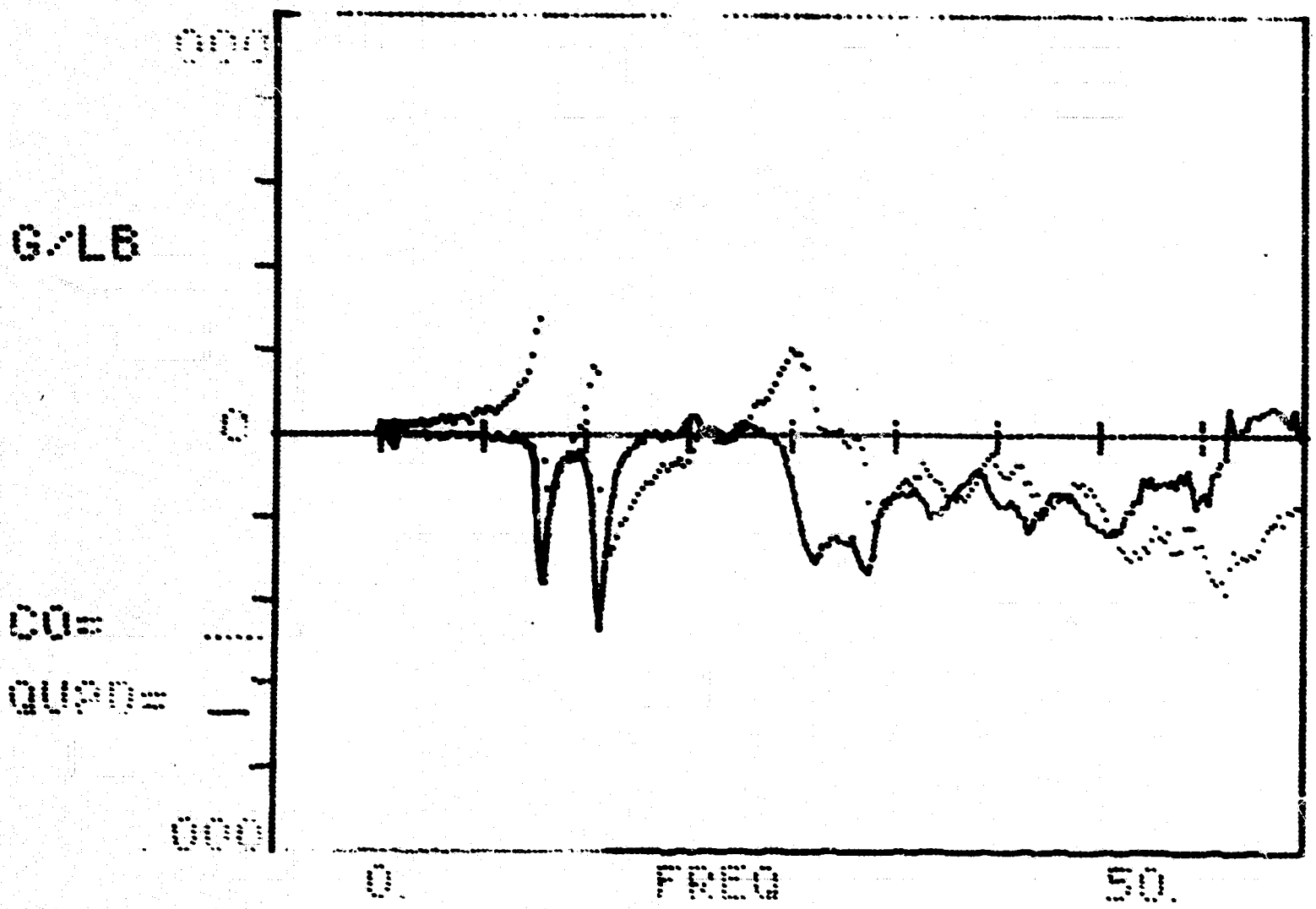


TRK TRAIN 11-4-74 RUN 20 WB
AV1/F8



11-4-74 RUN 29 WB

AV1/F8


G/LB
0
FREQ
50.
AV12/F8

ORIGINAL PAGE IS
OF POOR QUALITY

6.3 HZ MODE

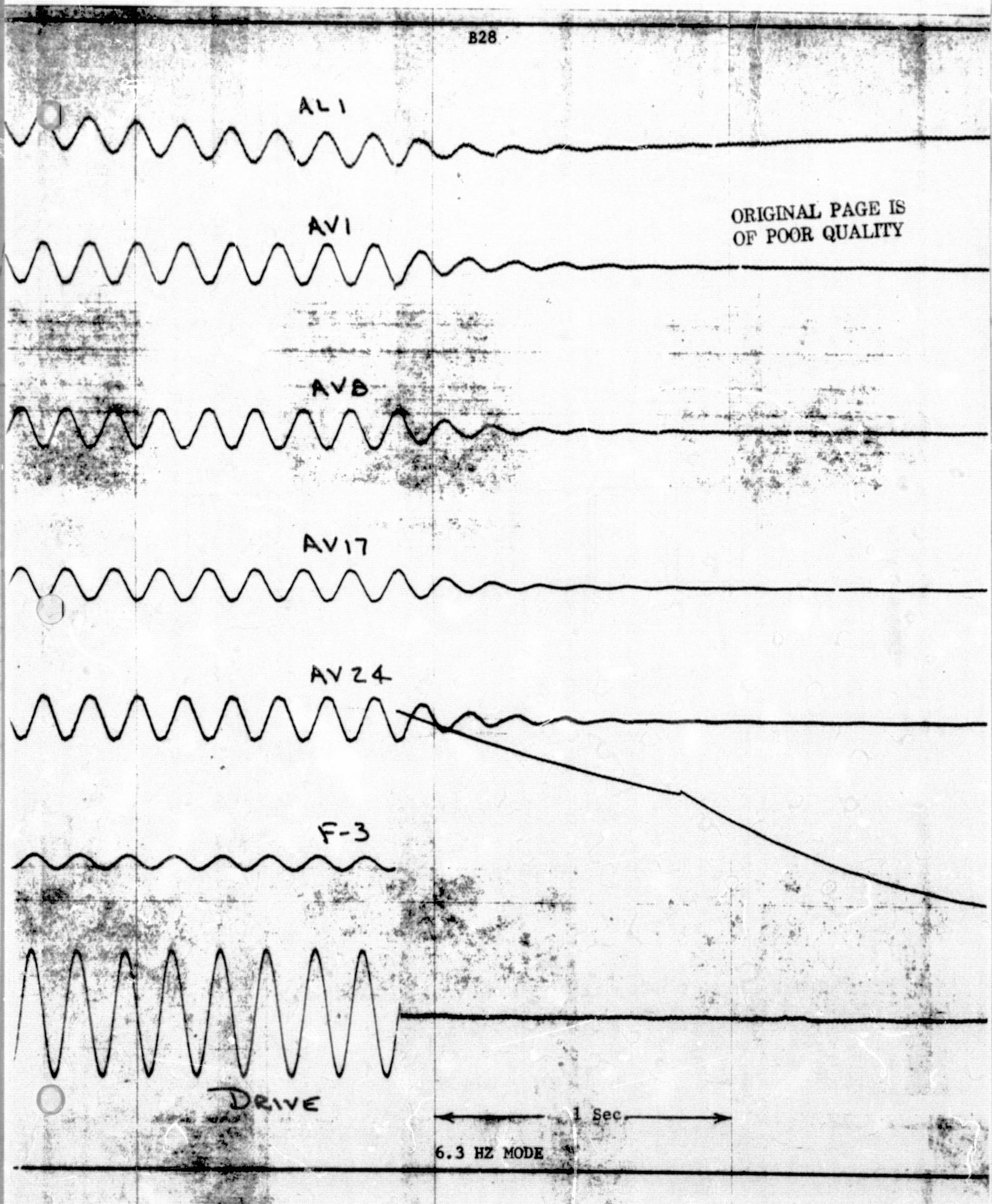
MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F3	-2.5E-04	-2.46E-03	AL1/F3	-2.6E-04	-2.49E-03
AV2	0.1	2.40	AL2/	3.3	-1.33
AV3	0.6	1.20	AL3/	-1.3	-1.19
AV4	1.9	0.29	AL4/	0.0	-0.14
AV5	2.0	-0.59	AL5/	-1.0	0.25
AV6	3.4	-1.68	AL6/	-1.7	1.04
AV7	1.4	-2.26	AL7/	-3.3	1.83
AV8	1.4	2.34	AL8/	-1.4	2.39
AV9	-0.3	0.41	AL9/	-7.3	2.65
AV10	-0.2	0.50	AL10/	-3.8	2.22
AV11	-0.1	0.29	AL11/	0.2	1.32
AV12	-1.1	0.09	AL12/	3.0	-0.19
AV13	0.0	-0.04	AL13/	0.8	-0.67
AV14	0.0	-0.11	AL14	-2.6	-1.57
AV15	-0.6	-0.35	AL15/	-4.3	-2.32
AV16	0.3	-0.41	AL16/	1.3	-1.71
*AV17	3.0	2.50	AL17/	-7.3	-0.77
AV18	1.0	-2.56	AL18/	-0.8	0.24
AV19	0.5	-1.39			
AV20	0.4	-0.33			
AV21	-0.5	0.46			
AV22	-5.4	1.16			
AV23	0.2	1.89			
AV24	-0.9	-3.08			
F1/F3	-1.15	5.568E-02			
F5	-0.9832	-0.165E-02			
F7	0.5119	4.066E-02			

* Tuning Measurements - AV17, F3 = 103 lb-pk

6.75 HZ MODE

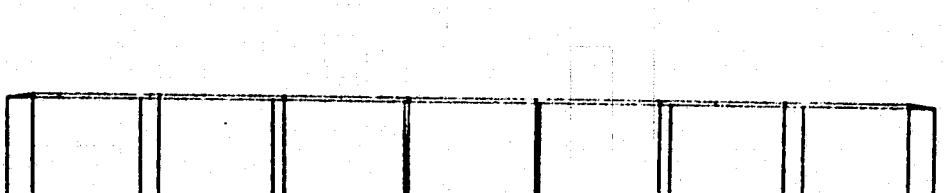
MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F3	-0.2E-04	2.9E-04	AL1/F3	-0.5E-04	2.4E-04
AV2	0.6	-2.8	AL2	0.5	2.1
AV3	0.4	-1.1	AL3	-0.1	1.2
AV4	0.1	-0.5	AL4	-.01	1.3
AV5	0.5	0.7	AL5	0.0	-0.1
AV6	0.0	1.6	AL6	0.1	-0.9
AV7	-0.4	2.8	AL7	0.4	-1.9
AV8	0.1	-2.9	AL8	0.3	-2.3
AV9	0.0	-0.3	AL9	2.1	-3.2
AV10	-0.1	-0.3	AL10	-0.2	-1.1
AV11	0.0	-0.2	AL11	-2.2	-1.3
AV12	0.0	-0.1	AL12	0.7	1.2
AV13	0.0	0.0	AL13	0.0	0.0
AV14	0.0	0.1	AL14	-0.3	1.6
AV15	-0.1	0.3	AL15	-0.4	1.8
AV16	-0.1	0.3	AL16	-0.5	1.7
*AV17	0.0	-2.4	AL17	-1.8	-0.5
AV18	-0.4	1.9	AL18	-0.6	-1.9
AL19	-0.2	0.4			
AV20	-0.1	0.3			
AV21	0.6	-0.7			
AV22	0.8	-0.9			
AV23	0.2	-2.1			
AV24	-0.3	2.9			
F1/F3	-0.9625	6.86E-03			
F5	-1.015	13.31E-03			
F7	0.9811	-11.61E-03			

* Tuning Measurements - AV17, F3 = 100 lb-pk



ORIGINAL PAGE IS
OF POOR QUALITY

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR UNDEFLECTED MODEL

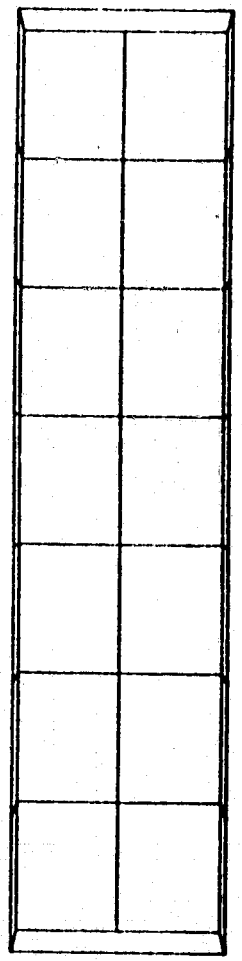
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 060E74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR UNDEFLECTED MODEL

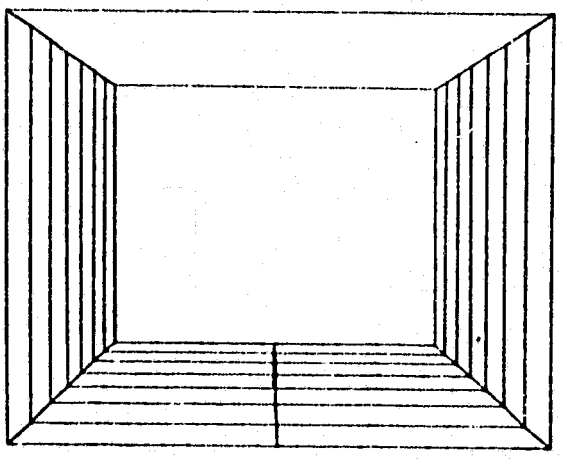
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

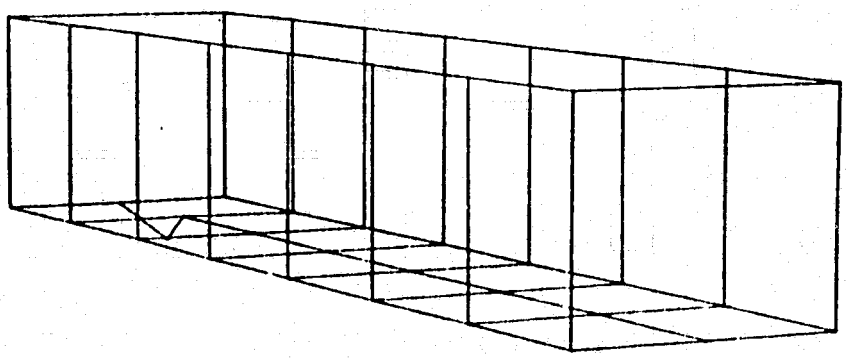
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

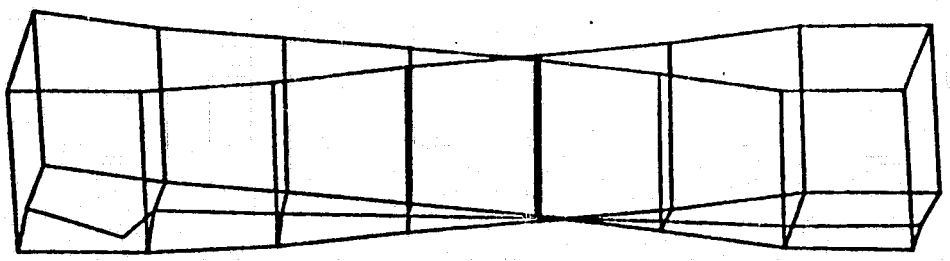
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.50000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-7.00000000E+02	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+02	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

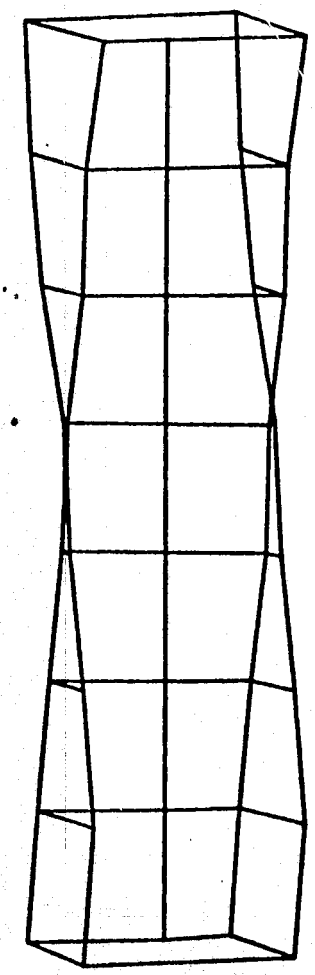
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(1) = 6.30HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 2.03000000E+02	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-2.00000000E+03	Y = 0.	CONE ANGLE = 20.0DEG
Z = 1.50000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH02	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(1) = 6.30HZ

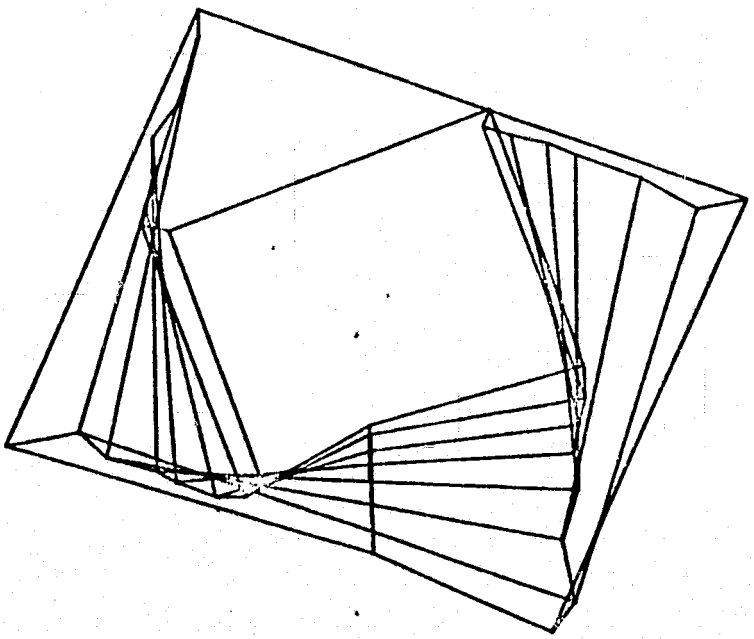
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

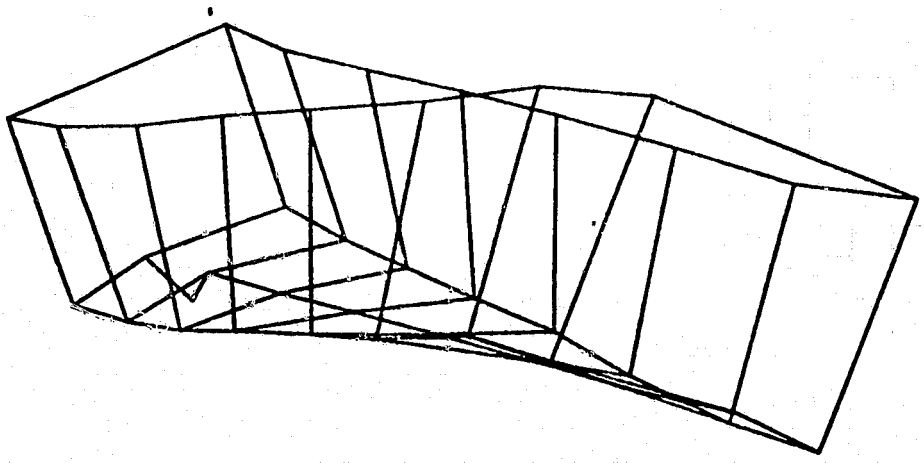
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(1) = 6.30HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

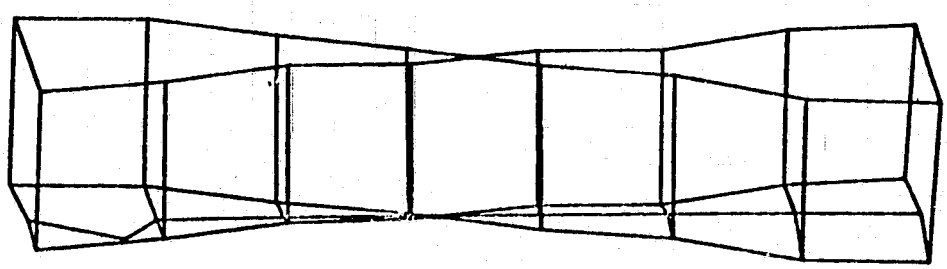
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(1) = 6.30HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.50000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-7.00000000E+02	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+02	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

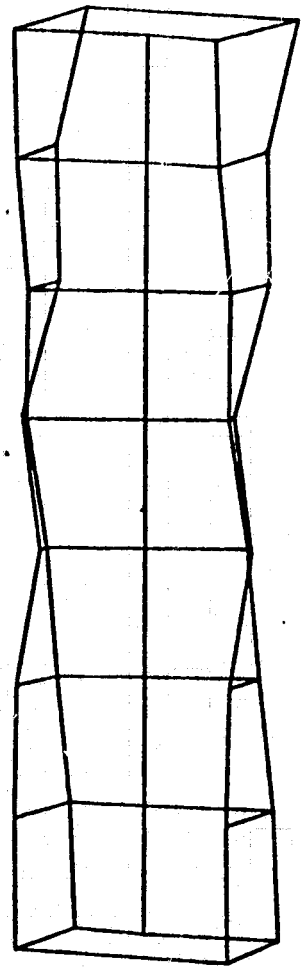
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .8, MODE(2) = 6.75 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 2.03000000E+02	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-2.00000000E+03	Y = 0.	CONE ANGLE = 20.0DEG
Z = 1.50000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH02	DATE = 06DE74	

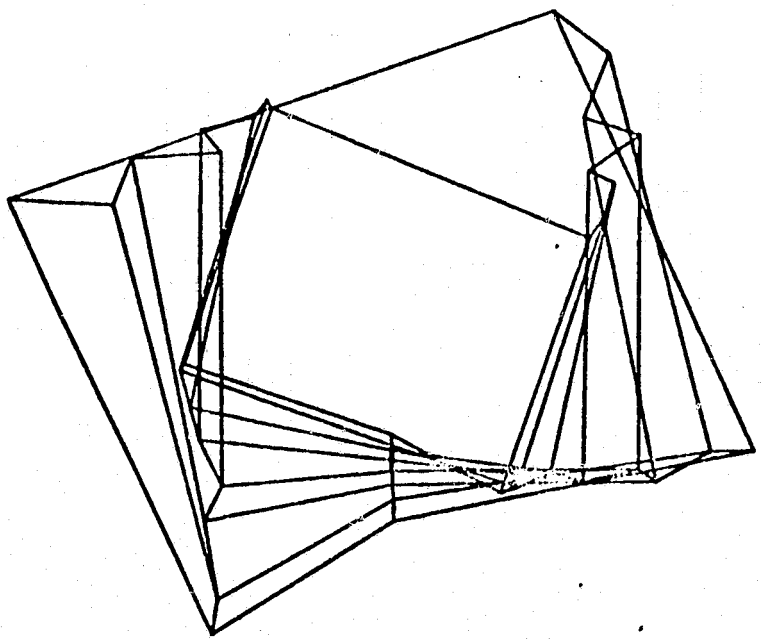
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .8, MODE(2) = 6.75 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 2.03000000E+02	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 2.00000000E+03	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH02	DATE = 06DE74	

LEFT EYE VIEW



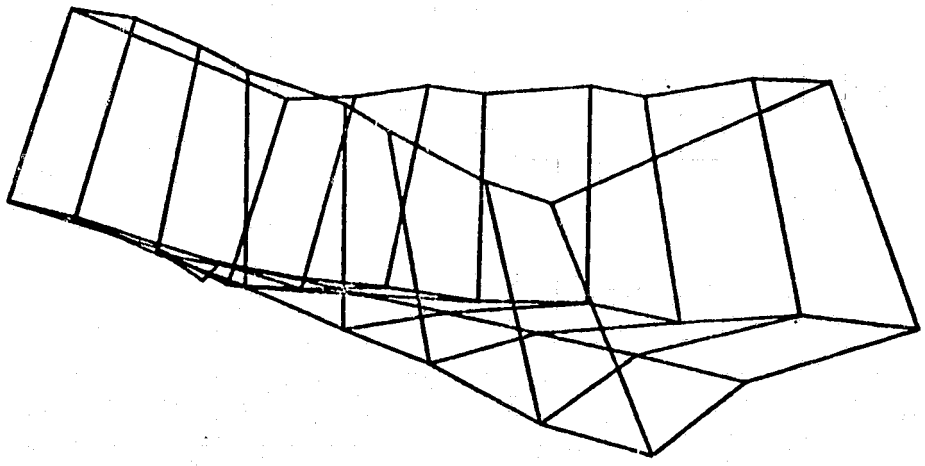
EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .8, MODE(2) = 6.75 HZ

CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01
RUN NO. = ORTH02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.
DATE = 06DE74

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .8, MODE(2) = 6.75 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

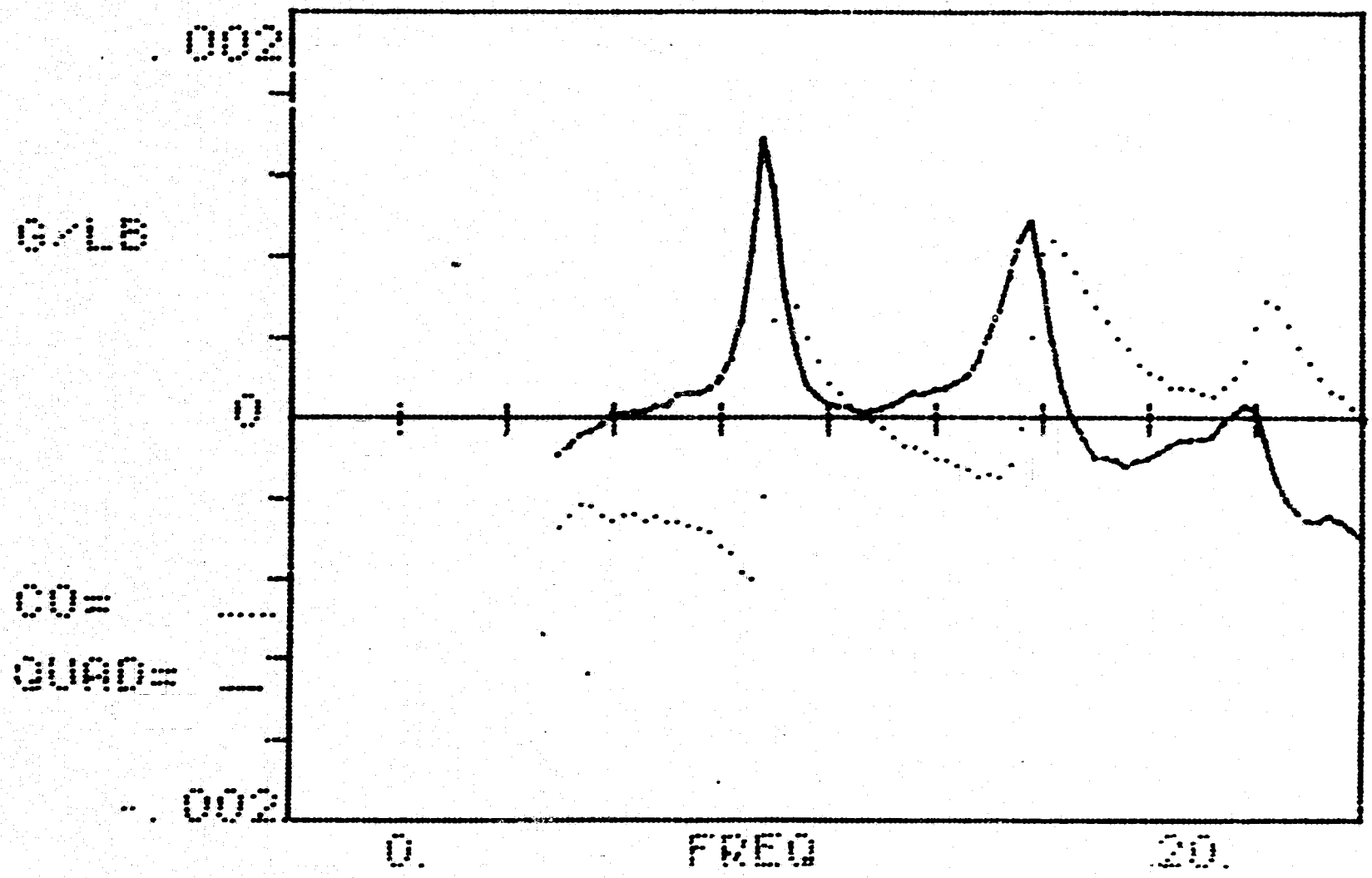
VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

8.85 HZ
MODE

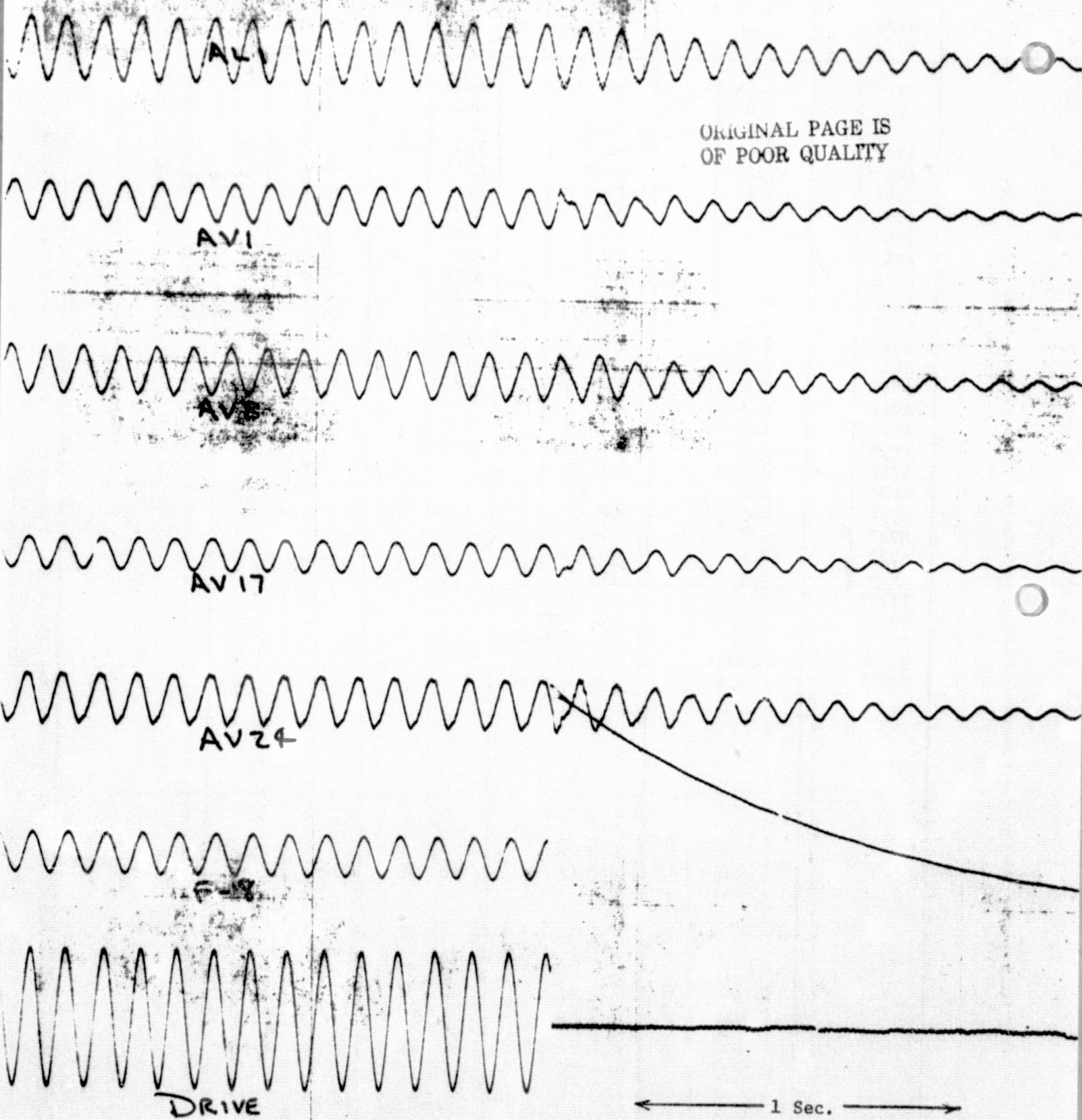
80.
FREQ
0.
2.
MHz
dB
dBsm
0.02
0
-0.04
dB/DIV
80.
FREQ
0.
2.
MHz
dB
dBsm
0.02
0
-0.04
dB/DIV


.002
G/LB
0
CO=
QUAD=
-.002
0.
FREQ
20.
INC= .2 HZ
TRK TRM 11-7-74 RUN 13 MB
AL 1/F8

B44
8.85 HZ MODE

MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F8	-4.6E-04	-6.1E-04	*AL1/F8	0.1E-04	1.39E-03
AV2	4.0	2.8	AL2	1.1	1.02
AV3	1.1	-3.2	AL3	3.0	-0.31
AV4	-0.4	-2.7	AL4	-3.7	-0.72
AV5	-1.2	-4.8	AL5	-3.2	-0.68
AV6	2.4	-22.5	AL6	-2.1	-0.22
AV7	1.8	4.6	AL7	1.2	1.08
AV8	-2.9	-9.9	AL8	2.9	1.38
AV9	0.2	0.3	AL9	0.1	0.32
AV10	0.4	-0.2	AL10	-1.6	1.77
AV11	0.2	0.6	AL11	2.6	-0.56
AV12	0.0	-0.2	AL12	-9.1	-3.81
AV13	0.0	-0.5	AL13	-9.4	-3.53
AV14	0.7	0.7	AL14	0.0	-0.25
AV15	0.1	0.1	AL15	10.7	2.64
AV16	0.3	0.7	AL16	6.5	2.85
AV17	3.7	5.7	AL17	0.1	0.53
AV18	-3.7	-2.2	AL18	-0.1	-0.44
AV19	-0.7	2.4			
AV20	0.1	9.2			
AV21	-0.1	6.7			
AV22	-1.7	3.4			
AV23	-2.5	-4.2			
AV24	3.4	10.1			
F1/F8	-0.6783	-1.1E-02			
F3	0.6399	2.076E-02			
F5	0.5033	1.889E-02			
F7	-0.4406	-0.344E-02			
F9	-0.9747	3.237E-02			

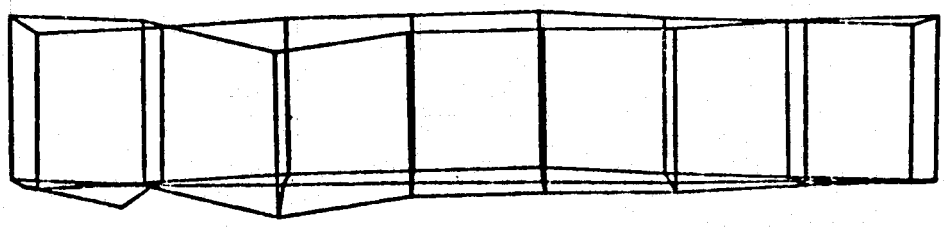
* Tuning Measurements - AL1, F8 = 29.7 lb-pk



ORIGINAL PAGE IS
OF POOR QUALITY

8.85 HZ MODE

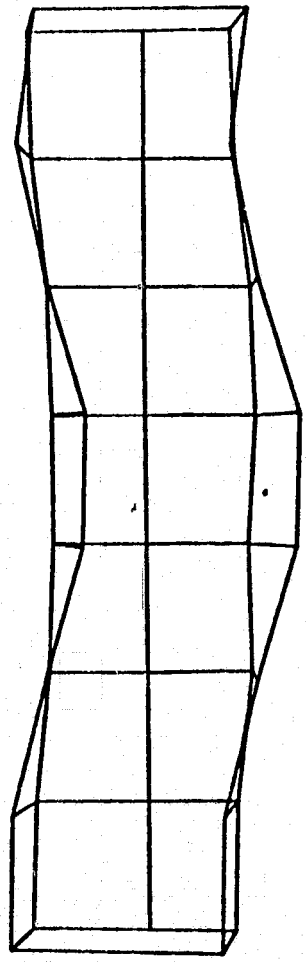
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(3) = 8.85HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-2.00000000E+03	Y = 0.	EYE TO EYE = 3.0 IN
Z = 1.50000000E+02	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(3) = 8.85HZ

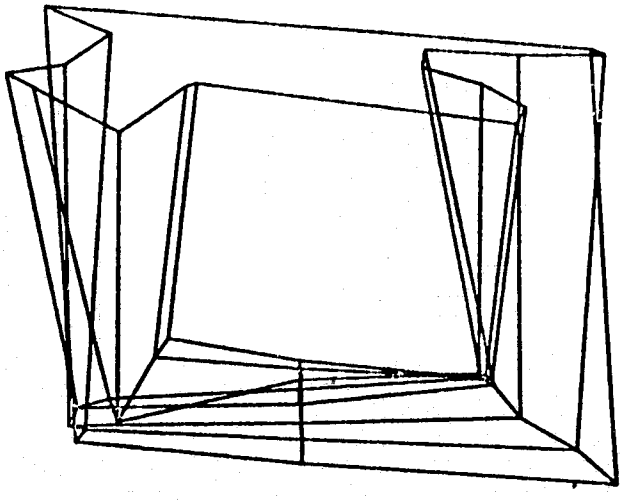
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(3) = 8.85 HZ

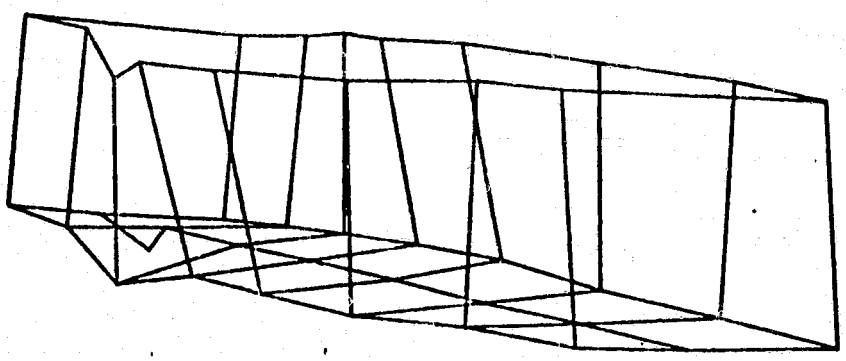
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .1, MODE(3) = 8.85HZ

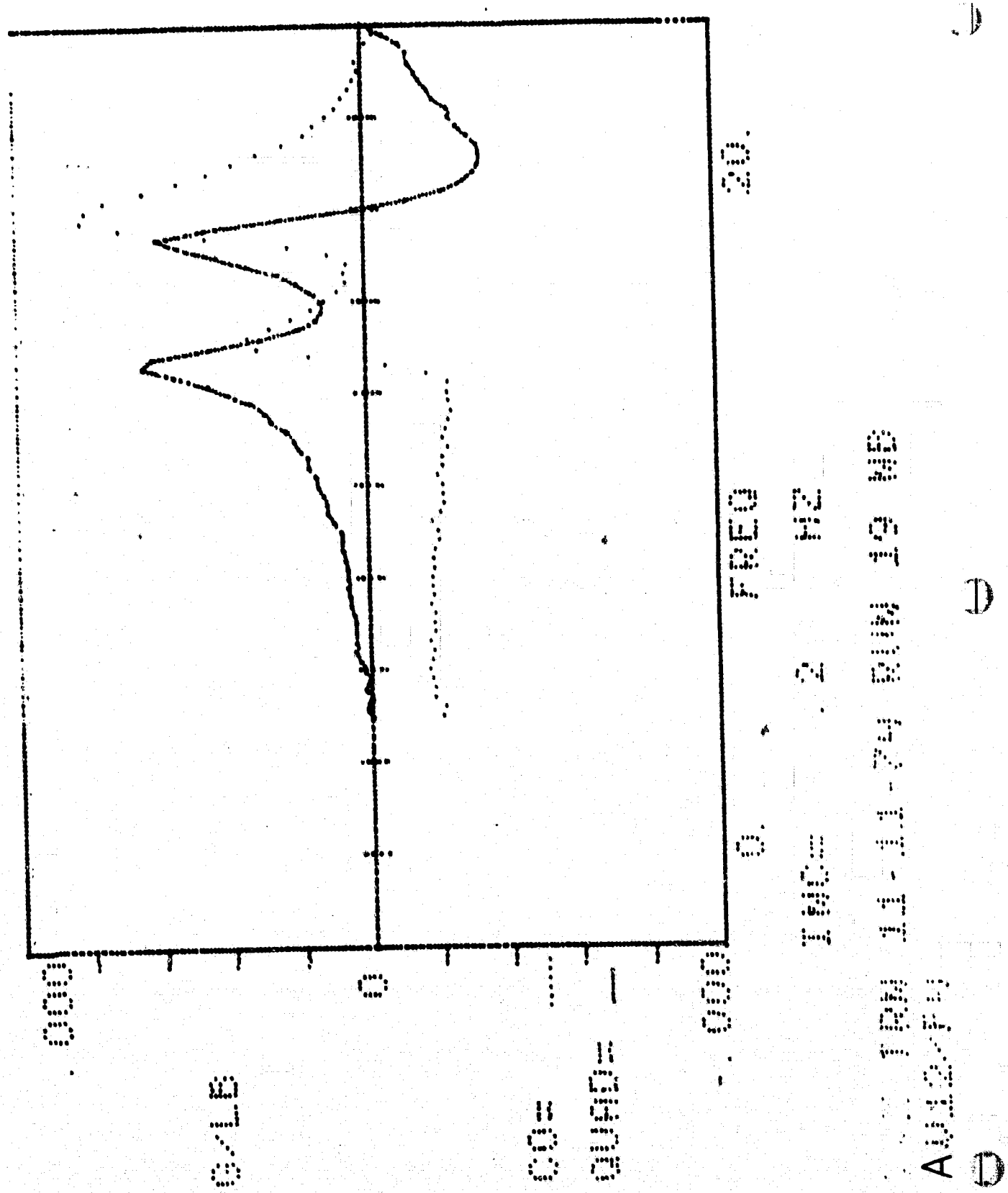
CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 060E74

11.9 & 12.3 HZ
MODE


-180
0
180
-90
0
90
AUDIO

11.9 HZ MODE

MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F4	-2.6E-04	-5.7E-04	AL1/F4	0.1E-04	0.8E-04
AV2	1.3	1.3	AL2	0.0	0.5
AV3	1.0	0.8	AL3	-0.6	0.4
AV4	0.2	-2.5	AL4	-0.8	-0.1
AV5	0.1	-4.2	AL5	0.4	0.9
AV6	1.2	-0.9	AL6	0.2	0.9
AV7	-0.1	0.9	AL7	-0.8	0.2
AV8	0.0	-5.0	AL8	-0.4	-0.7
AV9	-1.0	-5.8	AL9	2.1	3.8
AV10	-0.6	-1.9	AL10	0.3	0.7
AV11	-0.4	2.2	AL11	-2.3	-1.8
*AV12	-0.2	4.4	AL12	0.1	1.6
AV13	-0.4	3.8	AL13	2.6	3.4
AV14	-0.6	1.5	AL14	2.2	1.5
AV15	-0.8	-2.8	AL15	-1.0	-0.4
AV16	-1.0	-6.4	AL16	-1.9	-2.0
AV17	-0.4	-3.5	AL17	0.3	1.2
AV18	-0.1	1.0	AL18	0.7	-0.3
AV19	0.3	-1.8			
AV20	-0.4	-3.3			
AV21	0.0	-3.6			
AV22	0.5	-0.5			
AV23	0.0	1.9			
AV24	-2.1	-6.2			
F1/F4	-0.2082	8.84E-02			
F3	-0.2159	14.13E-02			
F4A	0.989	-1.886E-02			
F5	-0.2344	5.672E-02			
F7	-0.1898	16.2E-02			

* Tuning Measurements - AV12, F4 = 100 lb-pk

12.3 HZ MODE

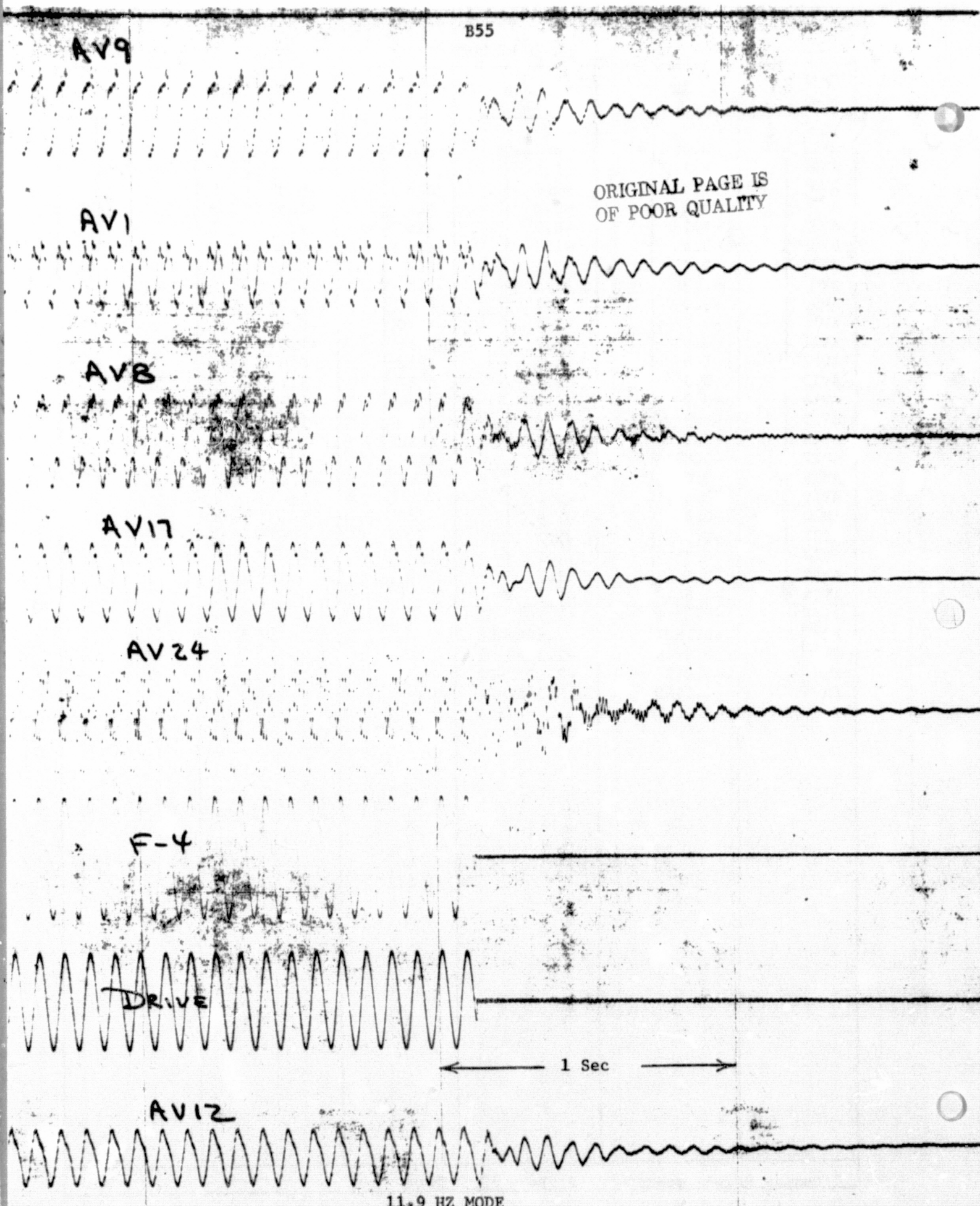
MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F4	-3.5E-04	-6.5E-04	AL1/F4	0.1E-04	1.1E-04
AV2	1.3	2.2	AL2	0.3	0.3
AV3	0.6	-0.5	AL3	-1.0	-0.5
AV4	0.0	-3.3	AL4	-1.3	-0.6
AV5	-0.1	-4.3	AL5	0.2	1.1
AV6	0.9	-1.3	AL6	0.8	0.1
AV7	-0.5	1.5	AL7	0.1	-0.2
AV8	-0.6	-5.8	AL8	-0.7	-0.9
AV9	-1.6	-6.9	AL9	1.6	3.0
AV10	-0.9	-2.4	AL10	0.5	1.4
AV11	-0.4	2.4	AL11	-1.7	-2.3
*AV12	0.0	5.0	AL12	0.1	-1.0
AV13	-0.3	4.2	AL13	1.7	3.9
AV14	-0.7	1.5	AL14	2.4	2.3
AV15	-1.0	-3.3	AL15	-1.2	-0.7
AV16	-1.5	-7.6	AL16	-2.3	-2.3
AV17	-1.0	-4.1	AL17	0.0	1.1
AV18	0.0	1.1	AL18	0.2	1.4
AV19	0.0	-1.9			
AV20	0.1	-4.2			
AV21	0.2	-4.1			
AV22	0.0	-0.8			
AV23	0.9	3.1			
AV24	-2.7	-7.2			
F1/F4	-0.193	5.059E-02			
F3	-0.1702	10.13E-02			
F4A	0.9827	-2.599E-02			
F5	-0.1859	1.852E-02			
F7	-0.1473	11.47E-02			

* Tuning Measurements - AV12, F4 = 49.5 lb-pk

12.4 HZ MODE

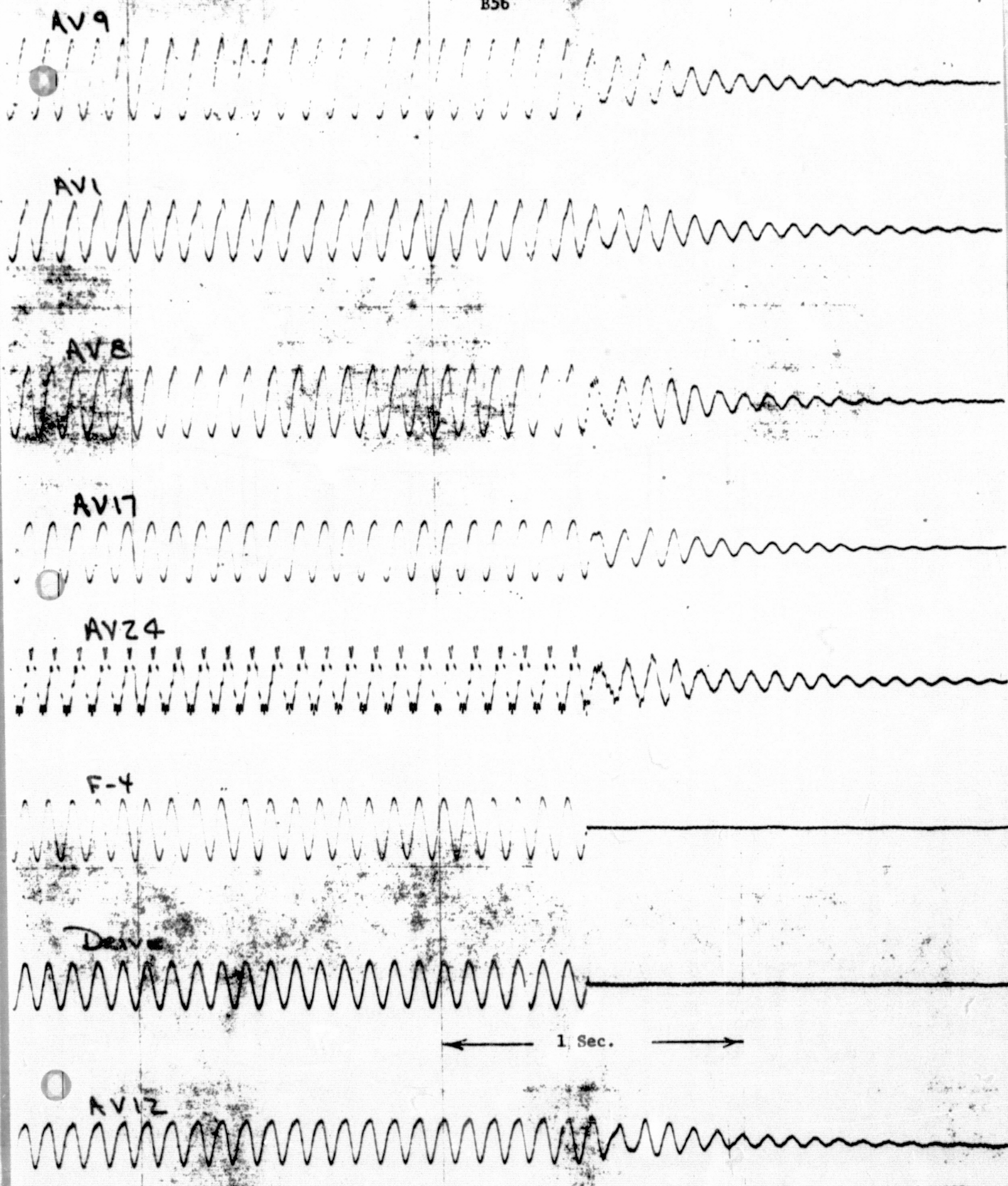
MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F4	-5.0E-04	-5.5E-04	AL1/F4	0.2F-04	0.4E-04
AV2	2.1	1.9	AL2	-0.1	-0.1
AV3	0.3	-0.8	AL3	-0.9	-0.3
AV4	0.0	-3.8	AL4	-1.3	-0.1
AV5	-1.1	-4.0	AL5	1.5	1.1
AV6	0.8	-1.2	AL6	0.5	1.0
AV7	-0.5	1.5	AL7	-0.6	0.2
AV8	-1.3	-5.5	AL8	-1.0	-0.2
AV9	-3.0	-6.2	AL9	2.9	3.1
AV10	-1.6	-2.4	AL10	-0.4	2.2
AV11	0.0	2.2	AL11	-1.5	-2.2
*AV12	1.0	4.8	AL12	-0.6	2.2
AV13	0.5	3.9	AL13	4.1	2.9
AV14	-0.9	4.0	AL14	4.7	0.2
AV15	-1.9	-3.2	AL15	-1.7	0.3
AV16	-3.2	-7.2	AL16	-3.0	-1.5
AV17	-1.8	-4.0	AL17	2.0	0.1
AV18	0.0	1.1	AL18	-0.4	1.4
AV19	-0.8	-3.1			
AV20	-0.8	-3.6			
AV21	-0.2	-2.7			
AV22	0.3	-1.1			
AV23	2.1	2.7			
AV24	-4.6	-6.3			
F1/F4	-0.2514	1.163E-02			
F3	-0.1827	7.666E-02			
F4A	0.9789	-2.399E-02			
F5	-0.242	-2.027E-02			
F5	-0.1649	9.345E-02			

* Tuning Measurements - AV12, F4 = 49.5 lb-pk



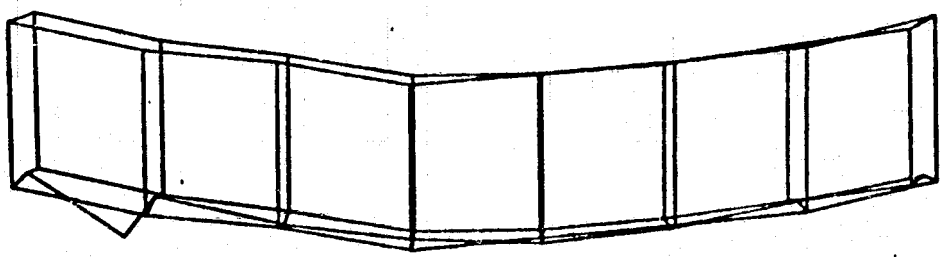
ORIGINAL PAGE IS
OF POOR QUALITY

11.9 HZ MODE



12.3 HZ MODE

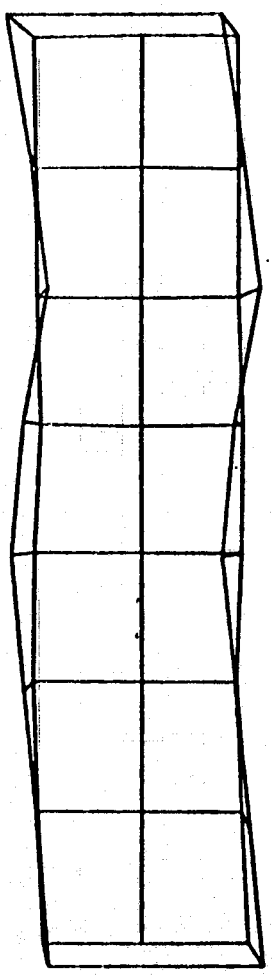
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .4, MODE(4) = 11.90 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-2.00000000E+03	Y = 0.	EYE TO EYE = 3.0 IN
Z = 1.50000000E+02	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

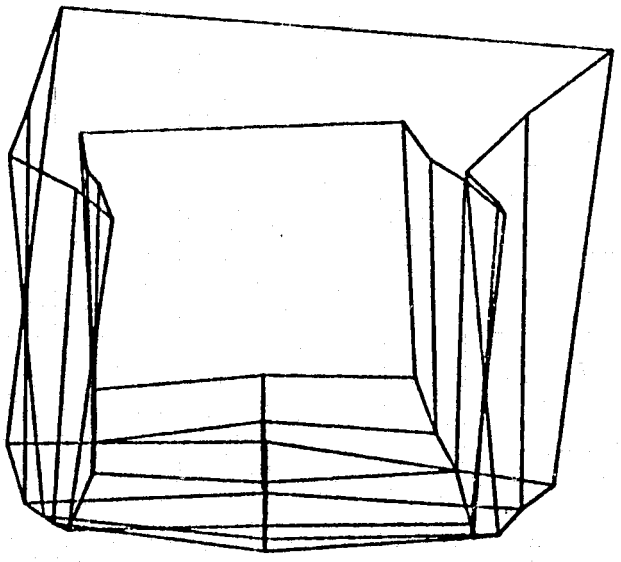
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .4, MODE(4) = 11.90 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+03	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

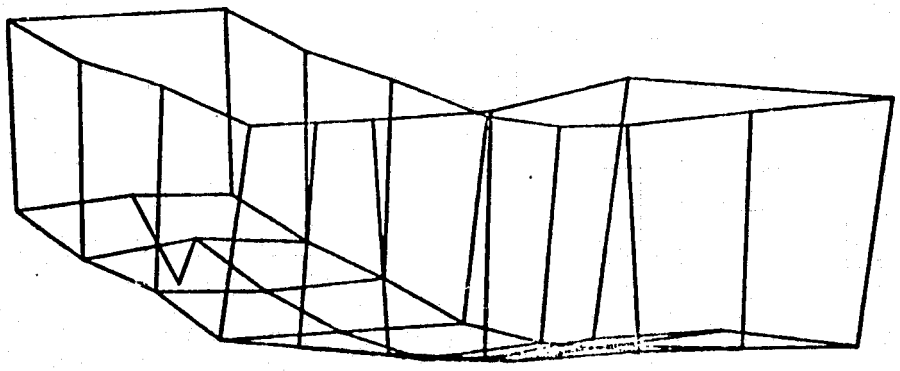
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .4, MODE(4) = 11.90 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH02	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .4, MODE(4) = 11.90 HZ

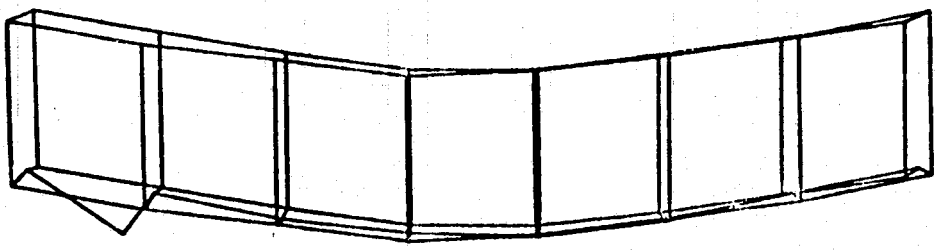
CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .3, MODE(5) = 12.30 HZ

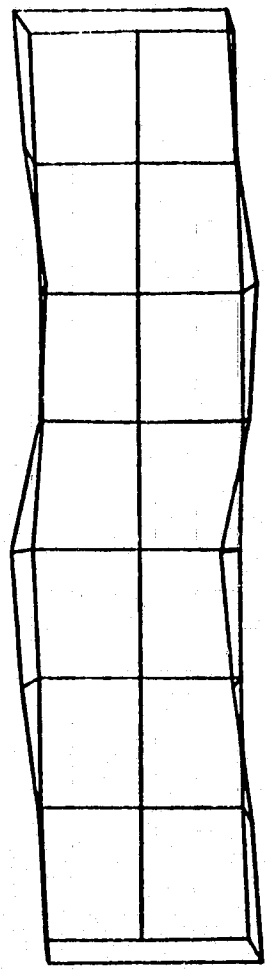
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

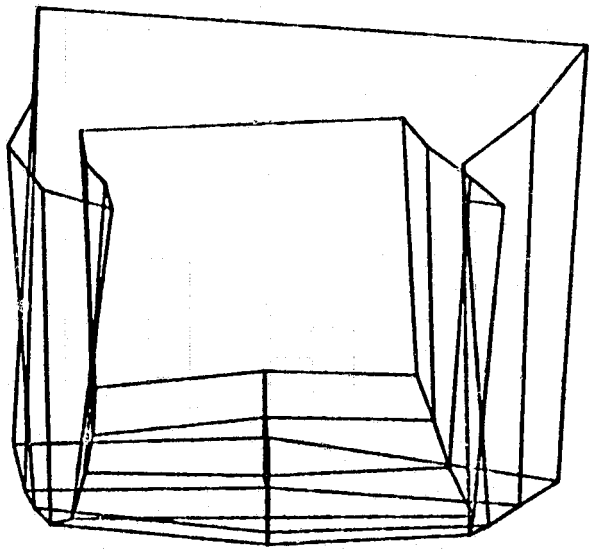
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .3, MODE(5) = 12.30 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+03	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

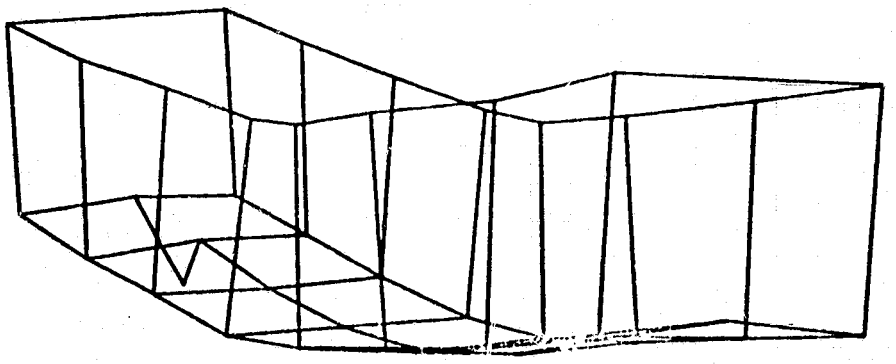
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .3, MODE(5) = 12.30 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH02	DATE = 06DE74	

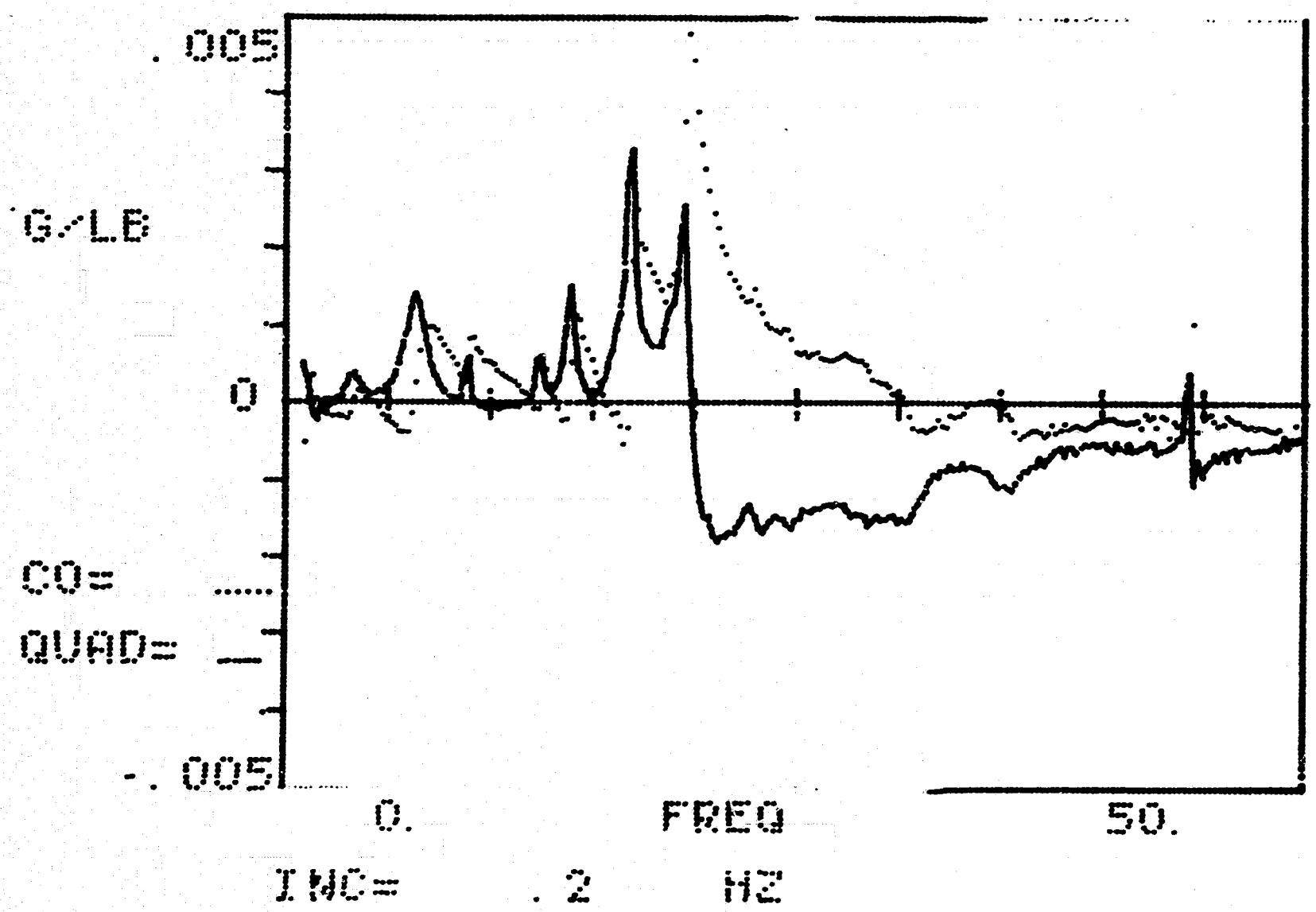
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .3, MODE(5) = 12.30 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.50000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-7.00000000E+02	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+02	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

13.6 HZ
MODE



TRN 11-8-74 RUN 31 WB
AU17²F3

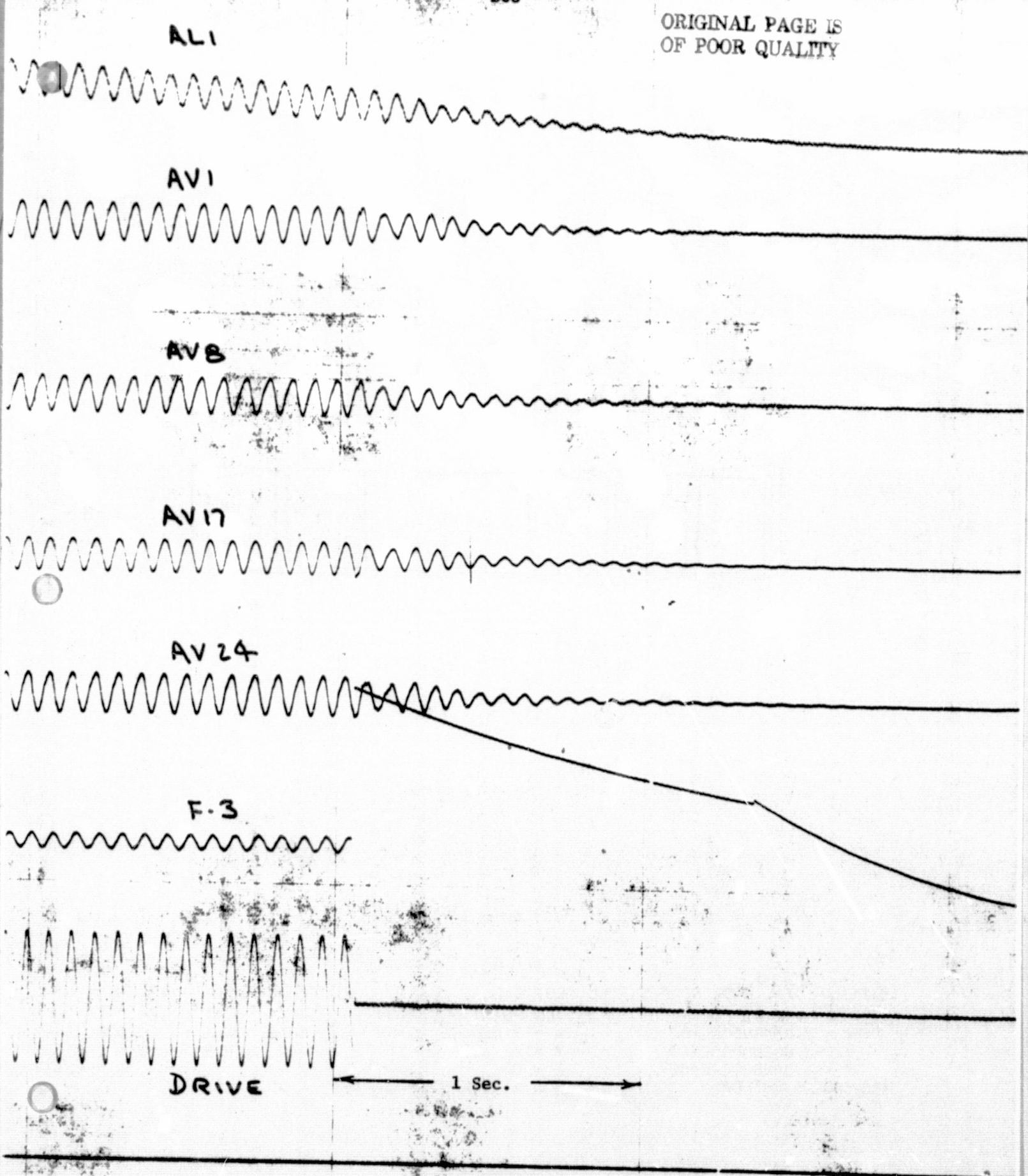
B66
ALL PAGE IS
POOR QUALITY

13.6 HZ MODE

MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	OUAD
AV1/F3	4.2E-04	-2.44E-03	AL1/F3	-8.8E-04	2.26E-03
AV2	1.2	0.85	AL2	-9.3	1.61
AV3	4.4	0.62	AL3	-5.4	0.24
AV4	4.3	0.13	AL4	-9.3	0.58
AV5	4.6	0.02	AL5	-6.9	0.33
AV6	15.1	-1.94	AL6	-5.6	-0.15
AV7	2.7	0.81	AL7	1.9	2.21
AV8	3.9	-2.61	AL8	-7.5	2.59
AV9	-1.2	0.15	AL9	0.0	0.0
AV10	-1.0	0.05	AL10	24.3	-3.02
AV11	1.2	0.04	AL11	33.4	-7.0
AV12	0.9	0.10	AL12	-14.0	3.11
AV13	0.1	0.06	AL13	-17.4	3.08
AV14	2.9	0.13	AL14	23.1	-7.13
AV15	0.9	0.08	AL15	23.8	-3.64
AV16	0.0	0.36	AL16	-13.8	4.87
*AV17	-2.3	2.30	AL17	-1.0	0.42
AV18	7.5	0.87	AL18	33.9	-2.37
AV19	-20.0	-0.12			
AV20	-6.8	-0.96			
AV21	-8.2	-0.56			
AV22	-20.8	0.32			
AV23	-2.9	-0.82			
AV24	-5.0	2.33			
F1/F3	-0.9838	-1.051E-02			
F5	1.004	6.509E-02			
F7	-0.8289	-1.766E-02			

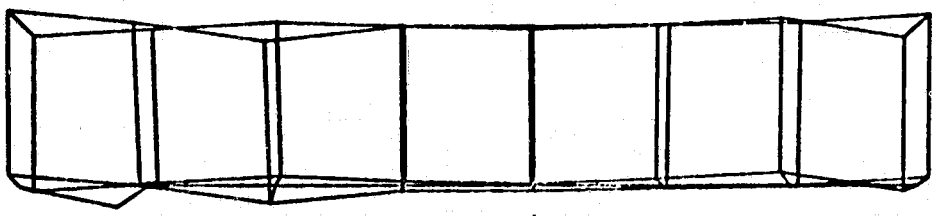
* Tuning Measurements - AV17, F3 = 110 lb-pk

ORIGINAL PAGE IS
OF POOR QUALITY



13.6 HZ MODE

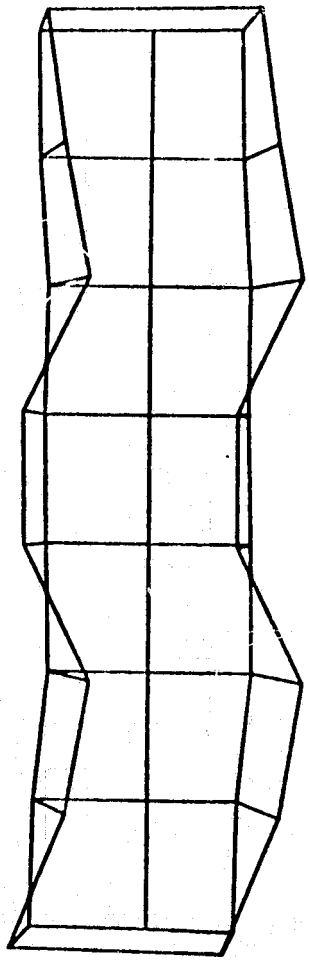
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(6) = 13.60 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-2.00000000E+03	Y = 0.	EYE TO EYE = 3.0 IN
Z = 1.50000000E+02	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(6) = 13.60 HZ

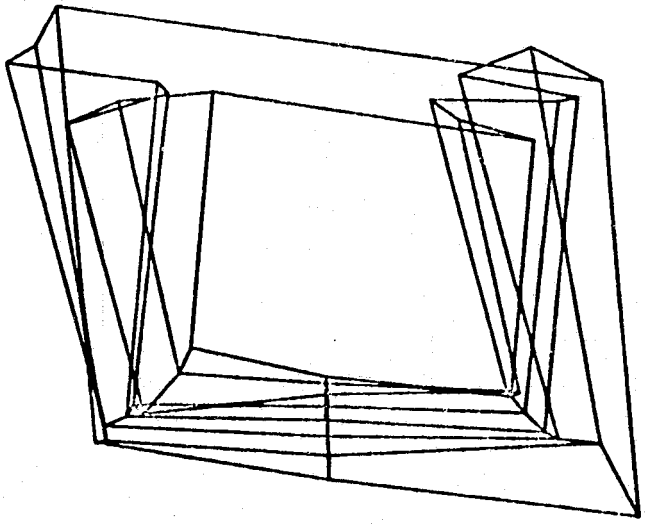
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

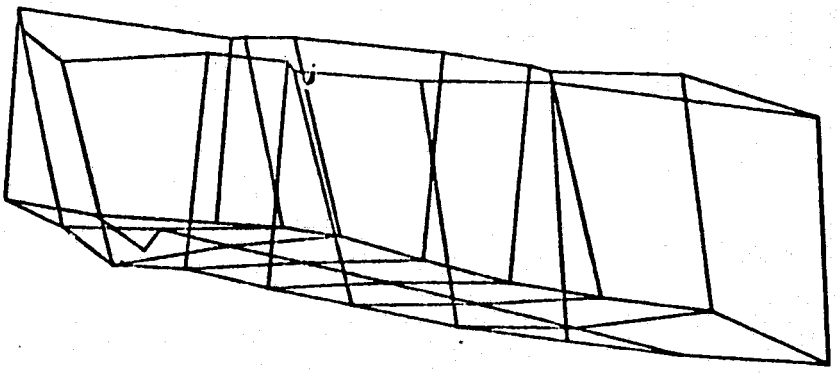
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(6) = 13.60 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTHO2	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(6) = 13.60 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.50000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-7.00000000E+02	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+02	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

14.55 & 14.75 HZ
MODE

14.55 HZ MODE

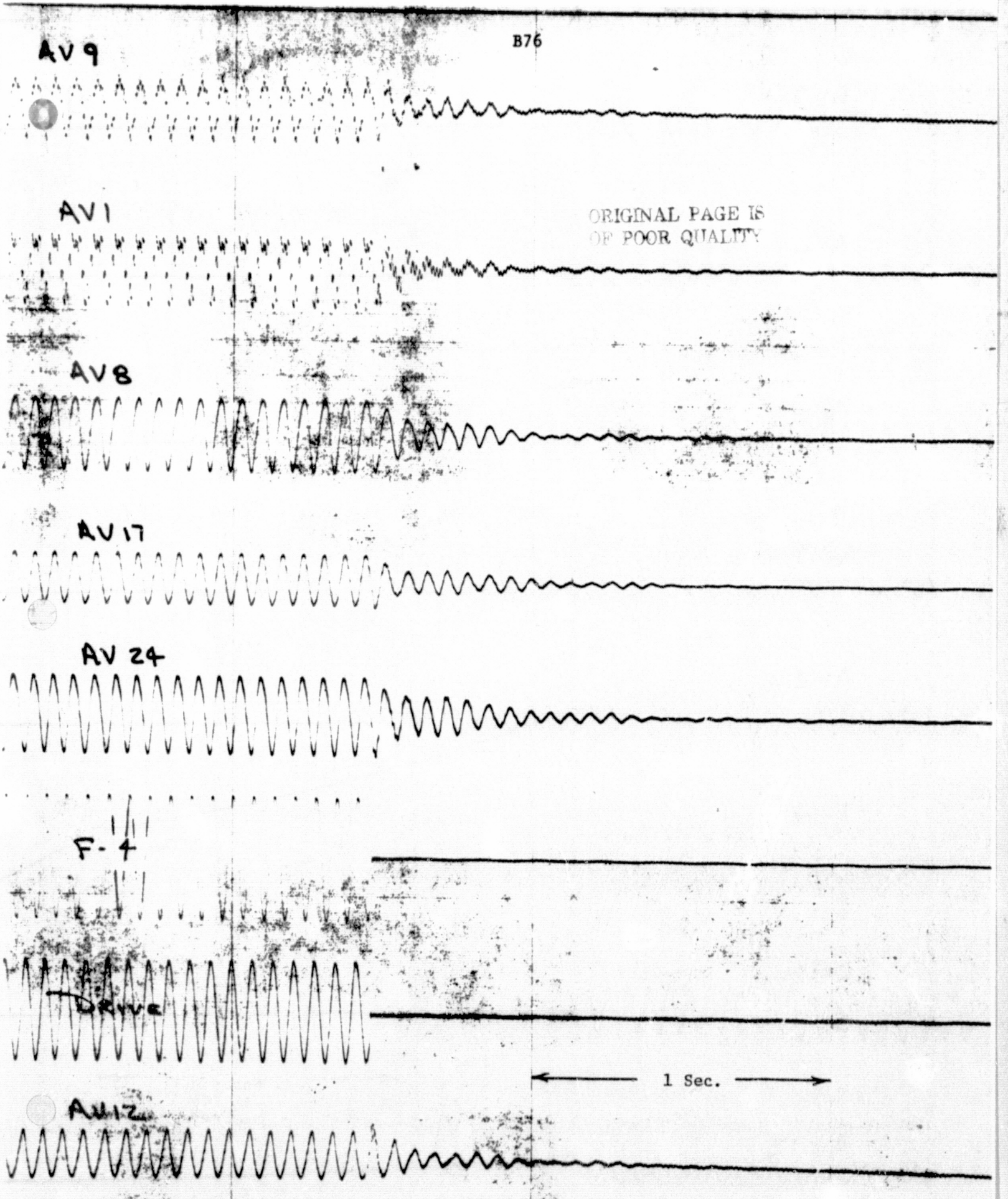
MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F4	-4.8E-04	-4.1E-04	AL/F4	0.2E-04	0.5E-04
AV2	1.7	0.7	AL2	-0.3	0.0
AV3	0.2	-1.6	AL3	0.3	0.7
AV4	-1.5	-2.4	AL4	0.3	0.5
AV5	-1.8	-2.6	AL5	0.0	-0.1
AV6	-0.8	-2.5	AL6	0.1	0.3
AV7	1.4	2.0	AL7	0.1	0.0
AV8	-5.4	-5.7	AL8	-0.6	-1.5
AV9	-4.8	-5.2	AL9	3.0	-0.7
AV10	-2.2	-2.0	AL10	3.3	5.2
AV11	0.4	1.8	AL11	0.2	-0.3
*AV12	2.7	4.5	AL12	-7.8	-13.8
AV13	2.5	4.2	AL13	-8.5	-14.8
AV14	0.5	1.4	AL14	3.3	4.1
AV15	-2.6	-3.1	AL15	7.9	9.9
AV16	-6.1	-7.3	AL16	0.1	-0.6
AV17	-3.8	-3.5	AL17	1.0	-0.2
AV18	1.3	1.8	AL18	0.0	0.0
AV19	-0.1	-0.9			
AV20	-0.9	-1.7			
AV21	-0.9	-2.1			
AV22	0.0	-1.0			
AV23	1.9	2.4			
AV24	-5.1	-5.8			
F1/F4	-0.1583	-8.733E-02			
F3	-0.2252	4.834E-02			
F4A	0.975	-2.693E-02			
F5	-0.1917	-3.152E-02			
F7	-0.2013	-3.466E-02			

* Tuning Measurements - AV12, F4 = 100 lb-pk

14.75 HZ MODE

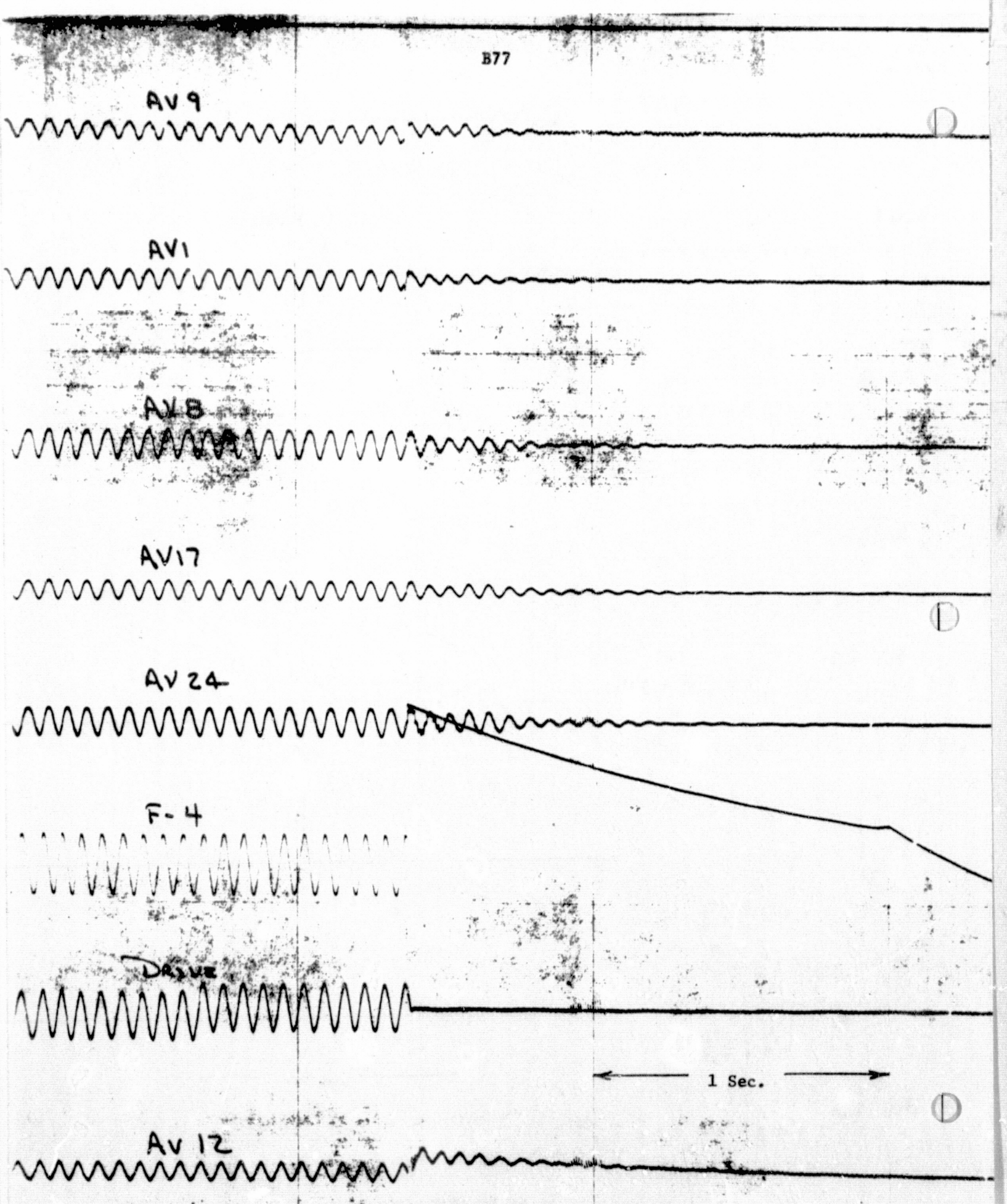
MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F4	-4.3E-04	3.9E-04	AL1/F4	-0.1E-04	0.5E-04
AV2	0.9	0.3	AL2	0.0	0.1
AV3	0.1	-1.4	AL3	0.0	0.4
AV4	-1.5	-2.8	AL4	0.0	0.9
AV5	-1.8	-3.6	AL5	-0.4	0.0
AV6	-0.7	-2.6	AL6	-0.1	0.1
AV7	1.3	2.4	AL7	0.0	-0.3
AV8	-4.8	-5.8	AL8	-0.2	-1.5
AV9	-3.9	-4.4	AL9	0.0	0.0
AV10	-2.2	-2.0	AL10	0.0	0.0
AV11	0.2	1.8	AL11	-0.7	-0.6
*AV12	2.0	4.5	AL12	-3.3	-14.17
AV13	1.8	4.3	AL13	-3.8	-14.02
AV14	0.1	1.8	AL14	1.2	3.9
AV15	-2.1	-3.0	AL15	3.6	10.12
AV16	-6.5	-6.7	AL16	0.0	-0.9
AV17	-3.3	-3.6	AL17	1.2	-0.1
AV18	0.8	2.4	AL18	4.8	-9.1
AV19	0.1	-0.6			
AV20	-1.2	-1.7			
AV21	-1.2	-1.5			
AV22	-0.1	-1.0			
AV23	1.3	1.9			
AV24	-3.9	-5.7			
F1/F4	-0.09934	-3.016E-02			
F3	-0.1904	6.792E-02			
F4A	0.9605	-3.096E-02			
F5	-0.1495	0.258E-02			
F7	-0.1531	-1.003E-02			

* Tuning Measurements - AV12, F4 = 49.5 lb-pk



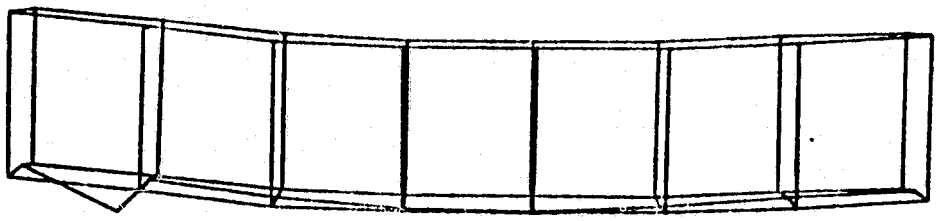
ORIGINAL PAGE IS
OF POOR QUALITY

14.55 HZ MODE



14.75-HZ MODE

LEFT EYE VIEW



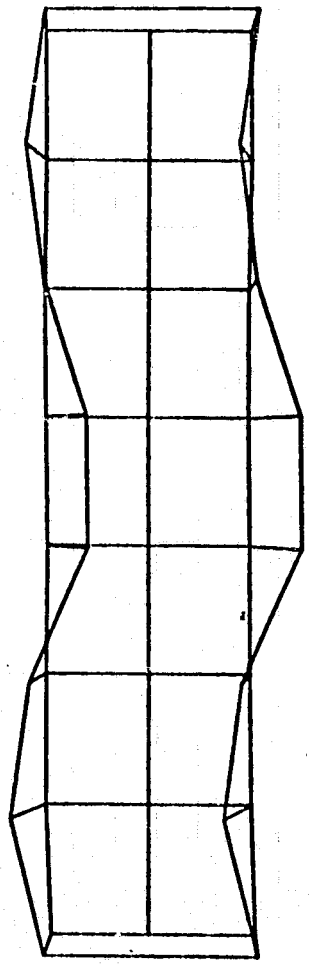
EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .2, MODE(7) = 14.55 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02
RUN NO. = ORTH02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.
DATE = 06DE74

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

LEFT EYE VIEW



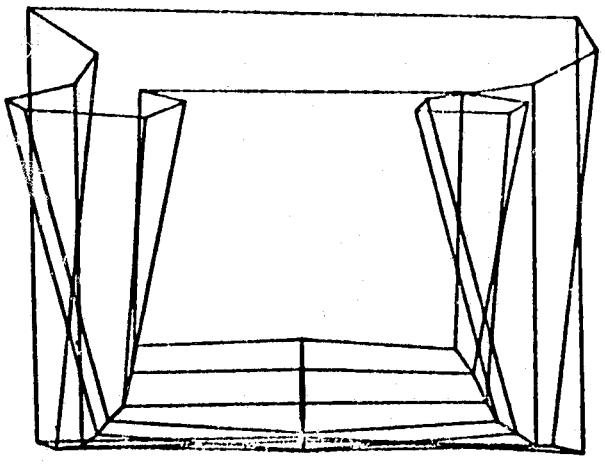
EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .2, MODE(7) = 14.55 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74



LEFT EYE VIEW

EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .2, MODE(7) = 14.55 HZ

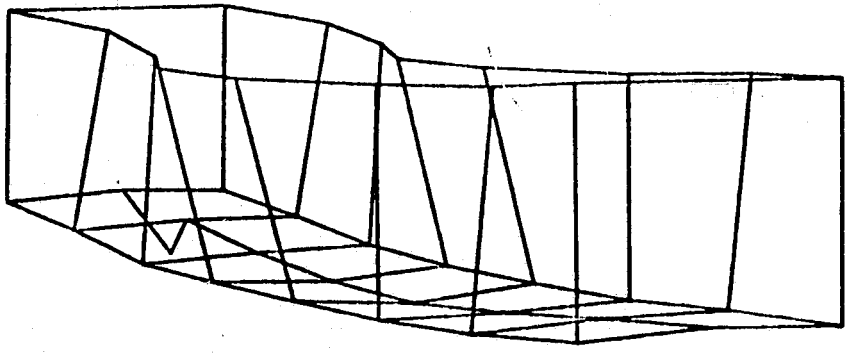
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .2, MODE(7) = 14.55 HZ

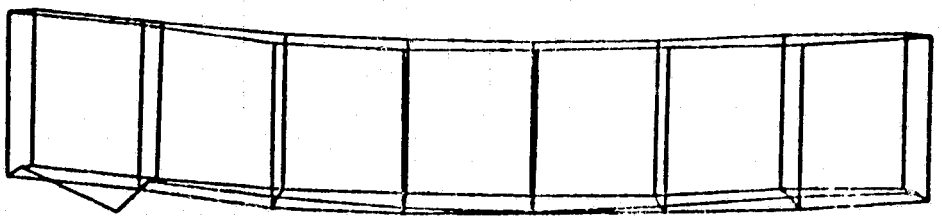
CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(8) = 14.75 HZ

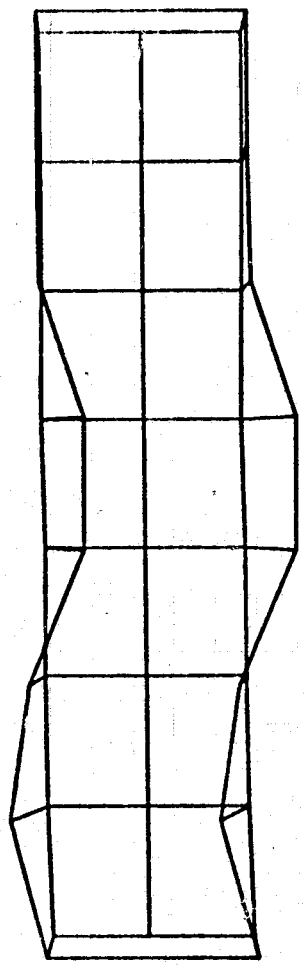
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



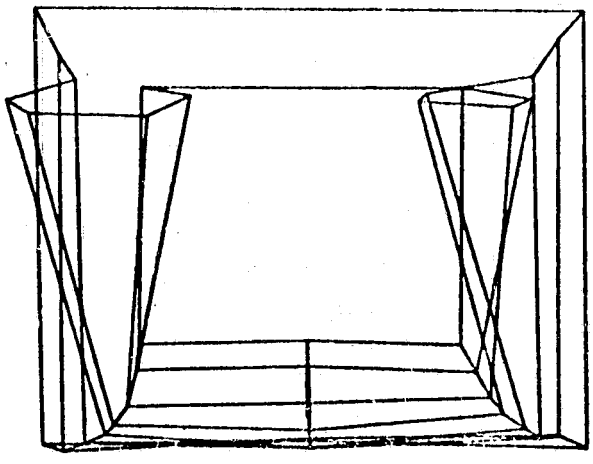
EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(8) = 14.75 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

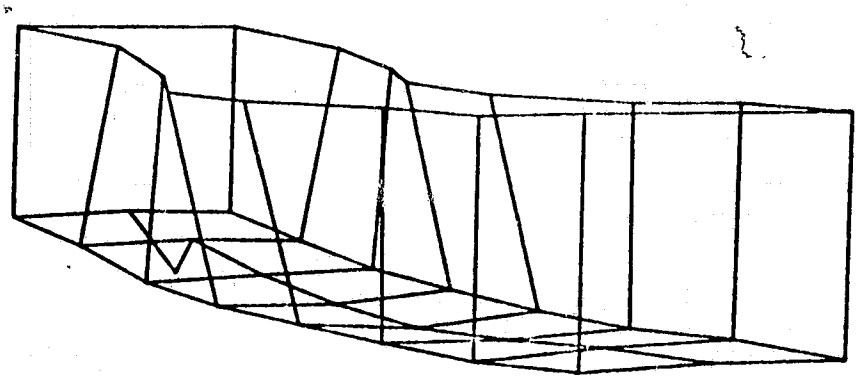


LEFT EYE VIEW

EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(8) = 14.75 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTHO2	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(8) = 14.75 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

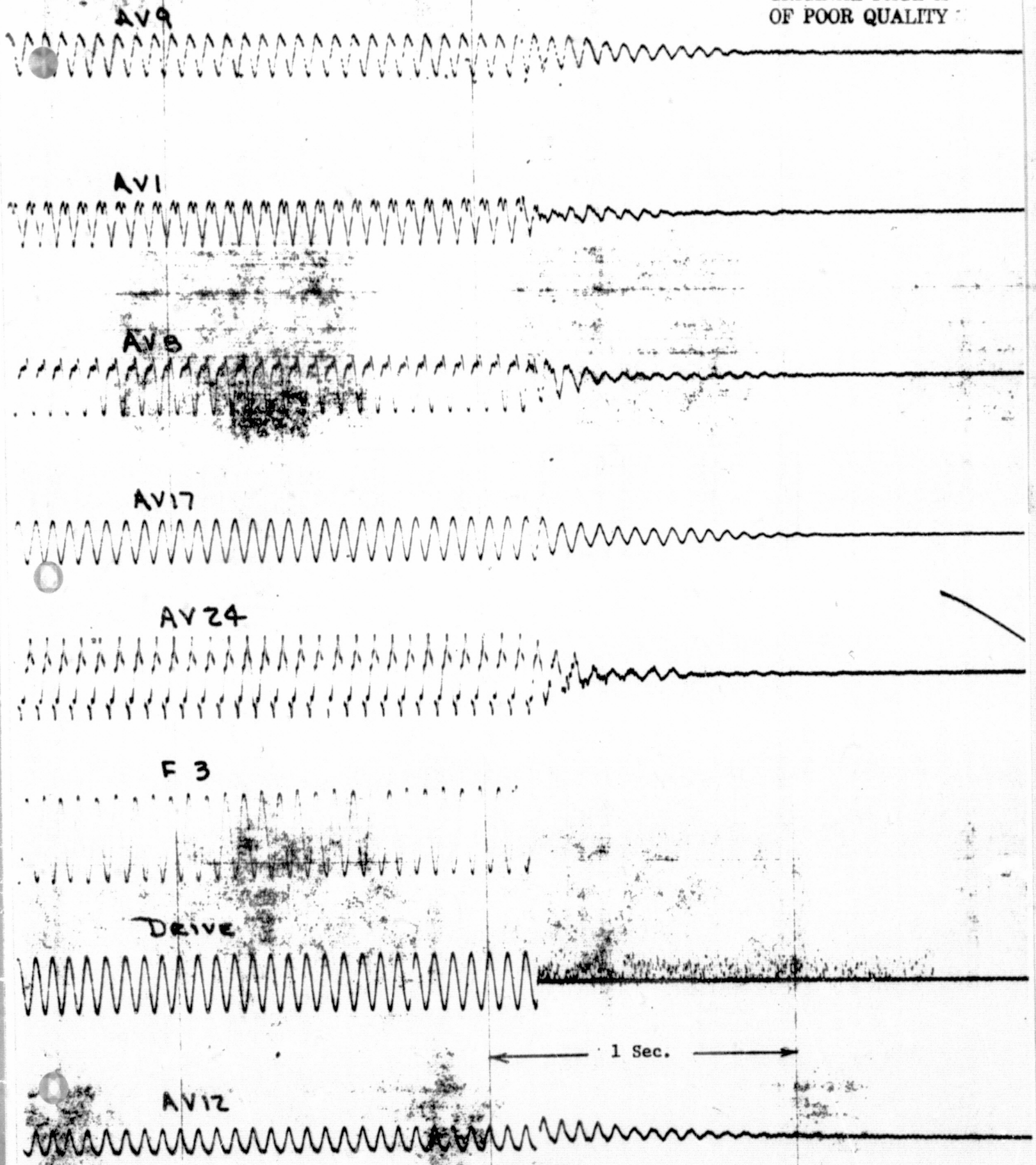
17.1 HZ
MODE

17.1 HZ MODE

MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F3	7.4E-04	1.82E-03	AL1/F3	-2.6E-04	-6.9E-04
AV2	-5.0	0.22	AL2	-2.4	-3.3
AV3	-2.0	1.25	AL3	-4.4	-5.3
AV4	0.3	0.53	AL4	-1.8	2.8
AV5	-0.9	-0.43	AL5	0.0	-2.3
AV6	4.4	-1.12	AL6	0.1	6.5
AV7	6.9	0.31	AL7	1.0	1.4
AV8	-4.1	-2.99	AL8	-0.7	-0.2
*AV9	7.4	2.33	AL9	-3.8	-3.0
AV10	4.9	-0.24	AL10	40.1	17.2
AV11	2.1	-1.92	AL11	1.1	55.4
AV12	4.0	-1.36	AL12	-19.6	44.2
AV13	2.9	1.06	AL13	-4.2	-33.3
AV14	0.1	2.11	AL14	3.7	-86.3
AV15	-9.5	-0.04	AL15	-10.6	-41.6
AV16	-20.5	-3.32	AL16	1.3	-6.6
AV17	5.1	2.39	AL17	-12.9	-13.6
AV18	-7.8	-0.98	AL18	-9.5	-14.0
AV19	-6.1	-0.06			
AV20	-2.4	0.08			
AV21	0.0	0.05			
AV22	2.3	0.11			
AV23	7.1	1.25			
AV24	-7.8	-3.33			
F1/F3	-0.01763	0.7569			
F3	-1.028	-0.1859			
F7	-0.8976	0.07378			

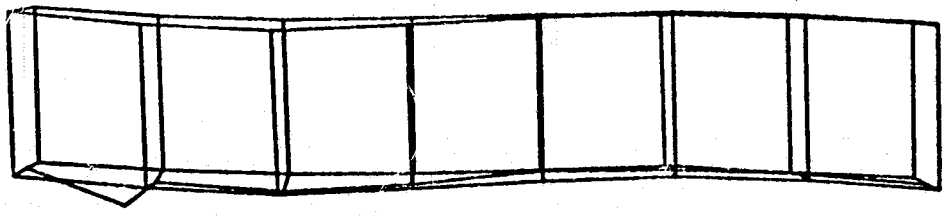
* Tuning Measurements - AV9, F3 = 125 lb-pk

ORIGINAL PAGE IS
OF POOR QUALITY



17.1 HZ MODE

LEFT EYE VIEW



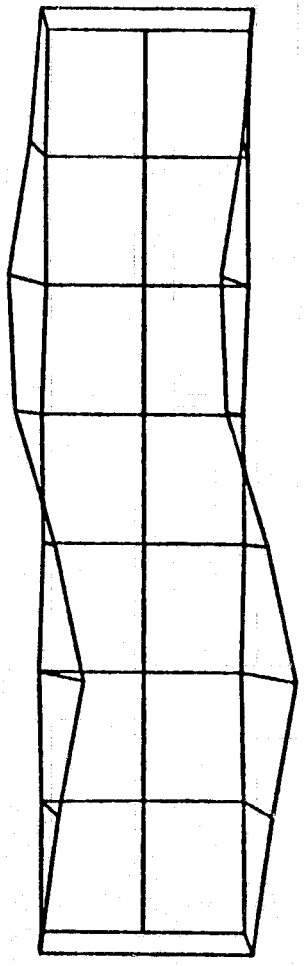
EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(9) = 17.10 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02
RUN NO. = ORTH02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.
DATE = 06DE74

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(9) = 17.10 HZ

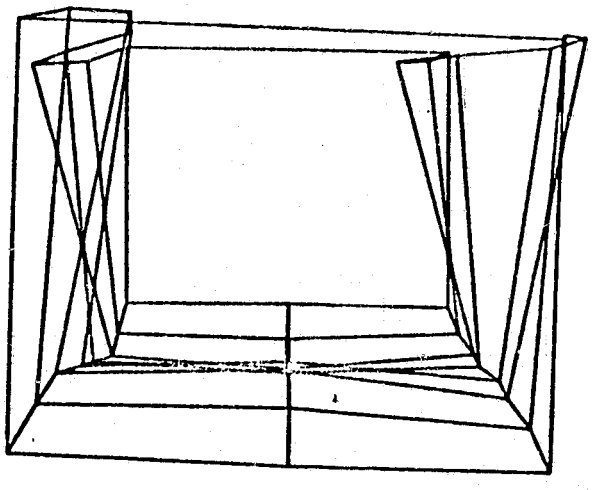
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(9) = 17.10 HZ

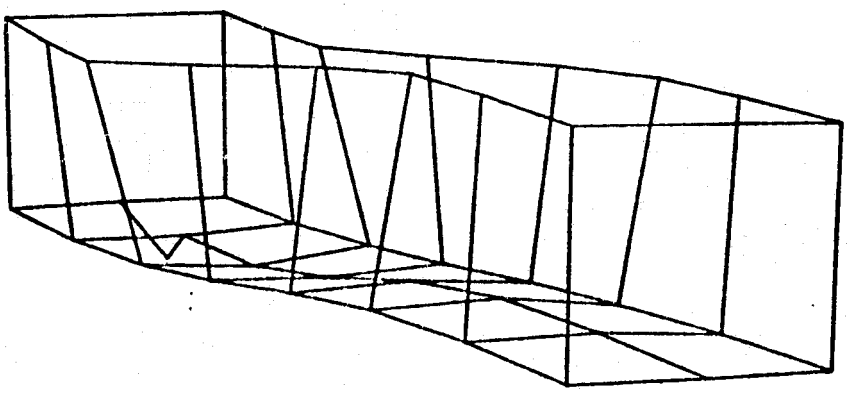
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(9) = 17.10 HZ

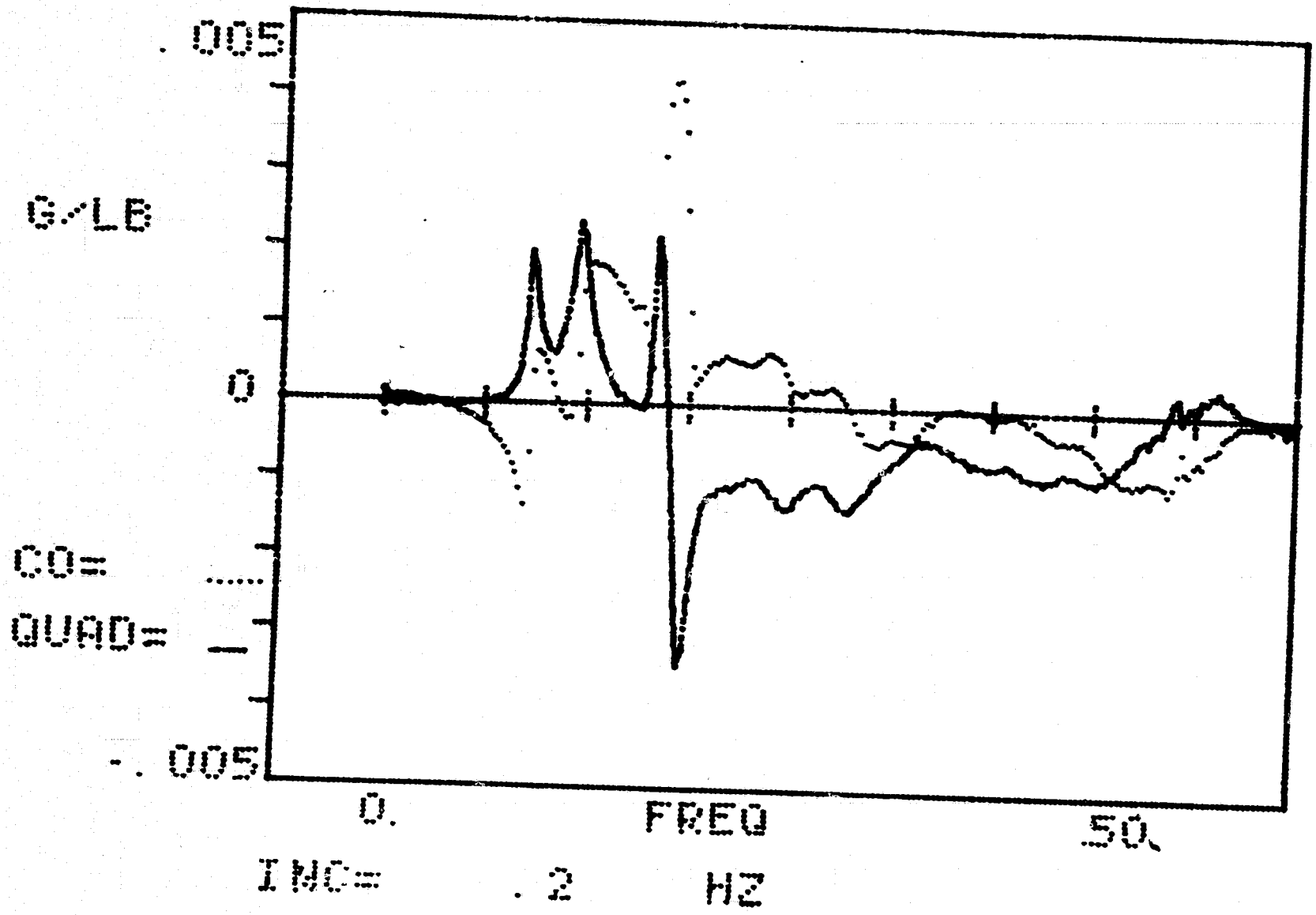
CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

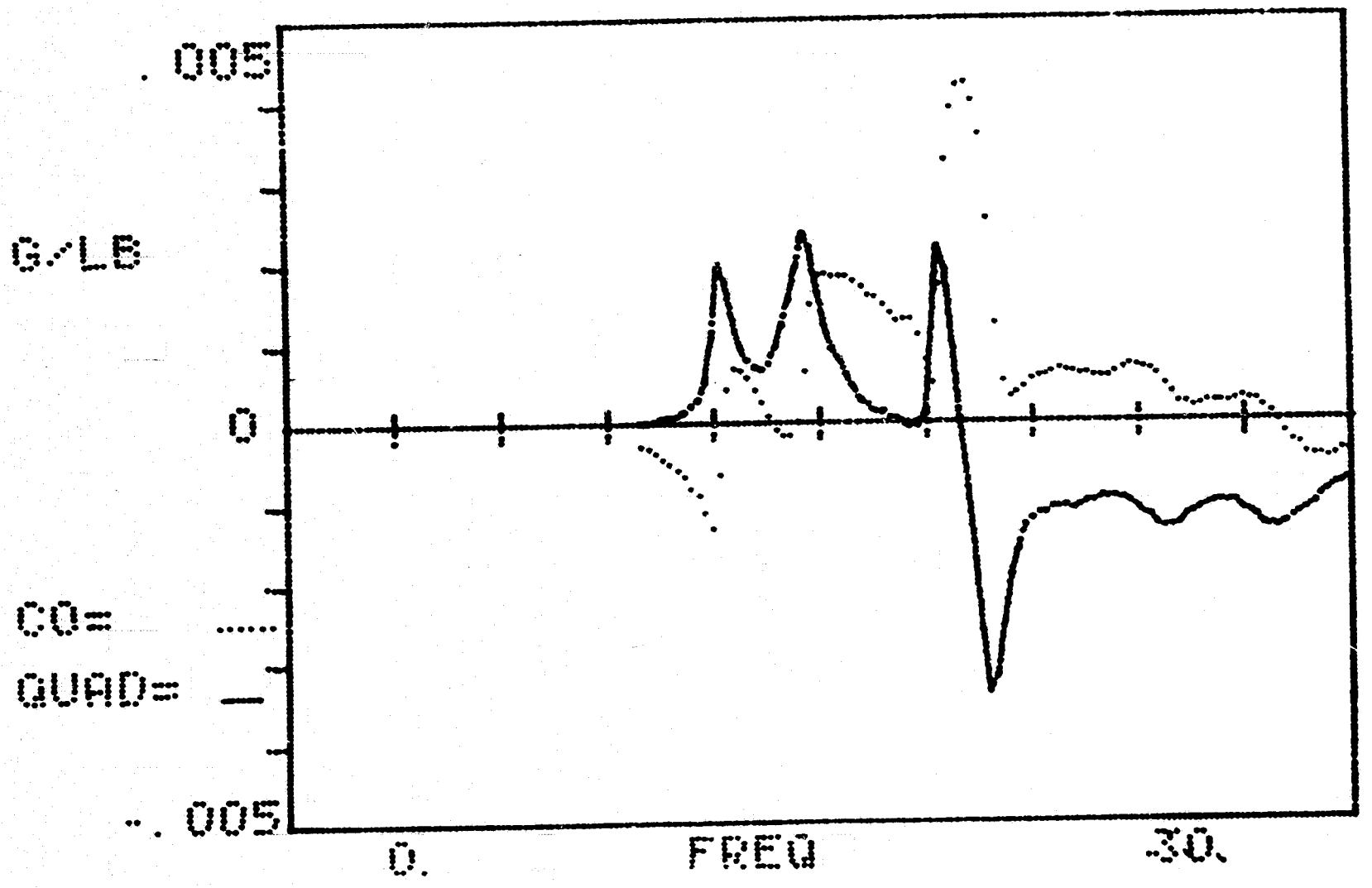
ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

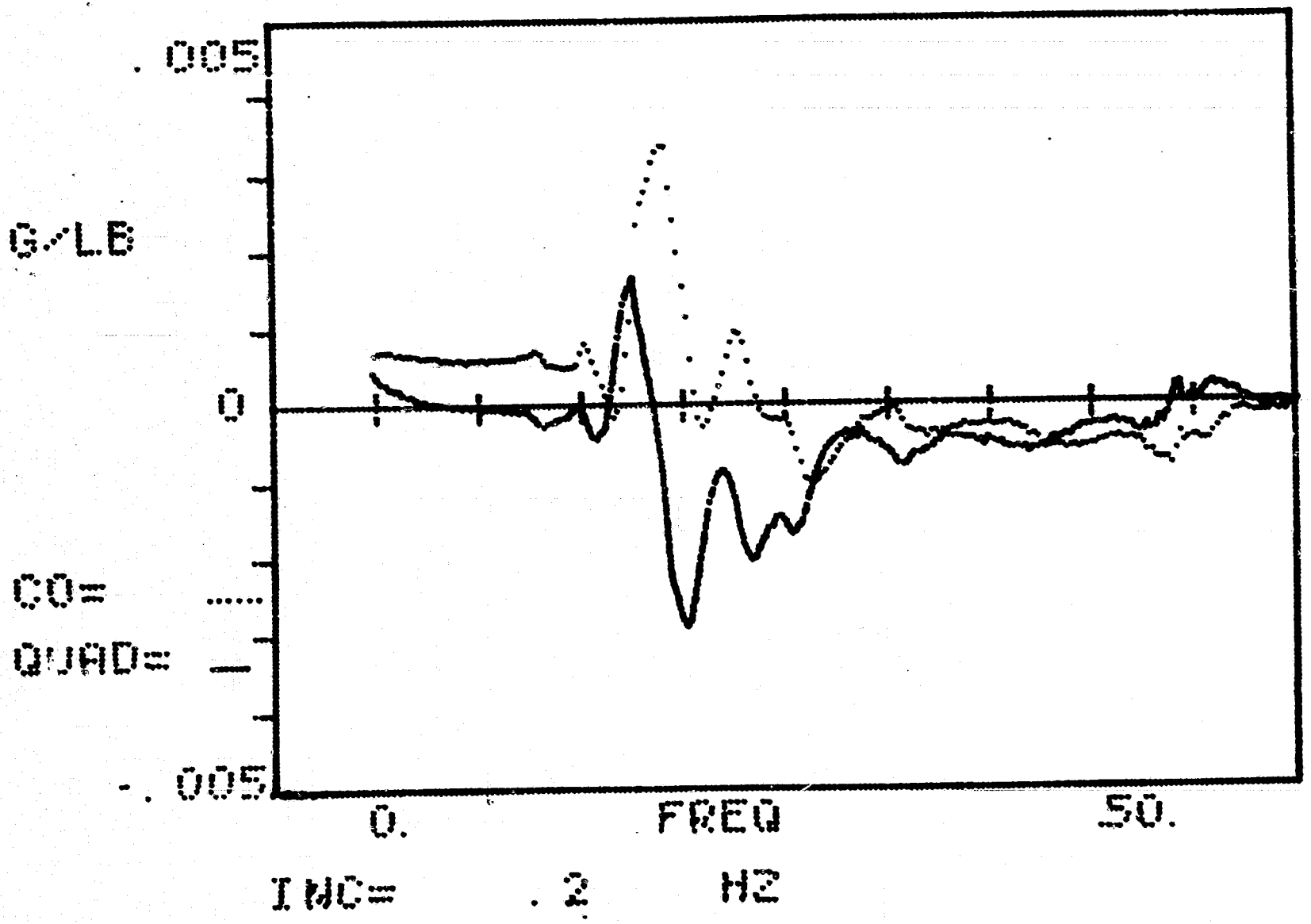
RUN NO. = ORTH02
DATE = 06DE74

20.2 HZ
MODE



TRK TRN 11-12-74 RUN 33 WB
AUG/F3


.005
G/LB
0
CO=
QUAD=
-.005
0.
FREQ
30.
INC= .2 HZ
TRK TRN 11-12-74 RUN 33 WB
AVG.*F3

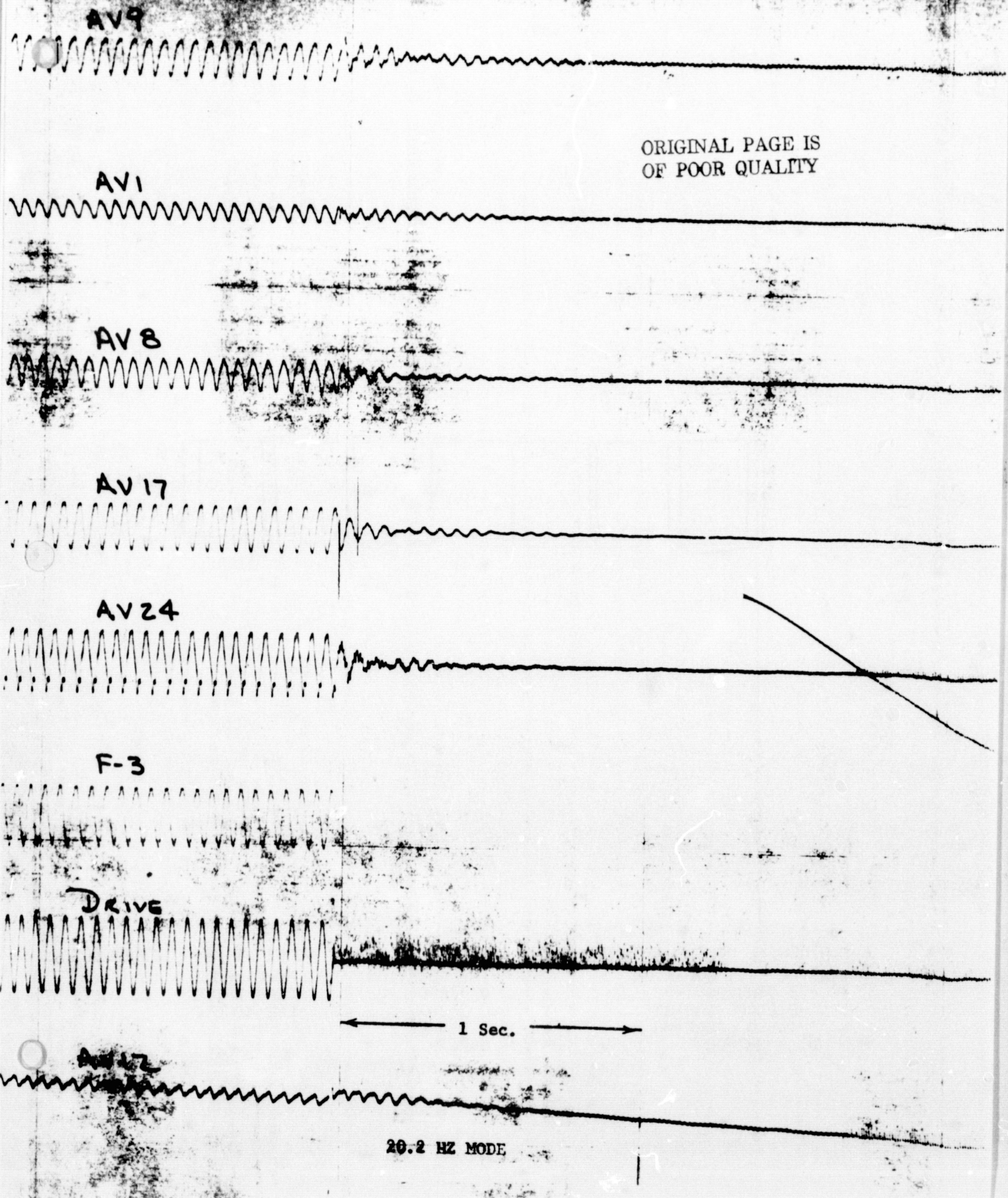


TRK TRN 11-12-74 RUN 34 WB
AVG/F3

20.2 HZ MODE

MEAS. NOS.	CO	QUAD	MEAS. NOS.	CO	QUAD
AV1/F3	9.3E-04	-6.7E-04	AL1/F3	14.1E-04	1.29E-03
AV2	-2.2	5.6	AL2	9.3	1.14
AV3	5.9	-0.4	AL3	-2.0	0.6
AV4	7.3	-1.7	AL4	-2.6	0.24
AV5	11.5	-6.0	AL5	3.1	-0.32
AV6	13.8	-9.0	AL6	1.4	-0.57
AV7	10.7	-1.9	AL7	2.5	-1.01
AV8	-25.5	-1.2	AL8	-4.4	-0.61
*AV9	15.0	-23.4	AL9	38.4	1.92
AV10	6.5	-3.0	AL10	17.6	-7.96
AV11	5.3	4.4	AL11	-6.0	-10.01
AV12	7.0	0.6	AL12	-44.1	-3.14
AV13	-3.5	-0.1	AL13	-12.9	5.93
AV14	-6.2	-3.7	AL14	-57.1	9.85
AV15	-8.6	4.2	AL15	-26.9	3.39
AV16	-32.0	31.6	AL16	-18.0	-1.01
AV17	39.1	1.7	AL17	5.5	1.25
AV18	-22.3	11.6	AL18	-6.7	0.62
AV19	-16.6	15.1			
AV20	-3.3	3.6			
AV21	5.4	-10.5			
AV22	18.5	-15.1			
AV23	24.2	-11.7			
AV24	-44.1	2.9			
F1/F3	0.9035	0.6812			
F5	-1.084	-0.1879			
F7	-0.8475	-0.6064			

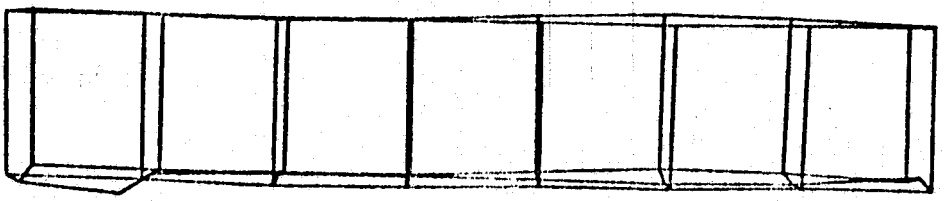
* Tuning Measurements - AV9, F3 = 95 lb-pk



ORIGINAL PAGE IS
OF POOR QUALITY

20.2 HZ MODE

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(10) = 20.20 HZ

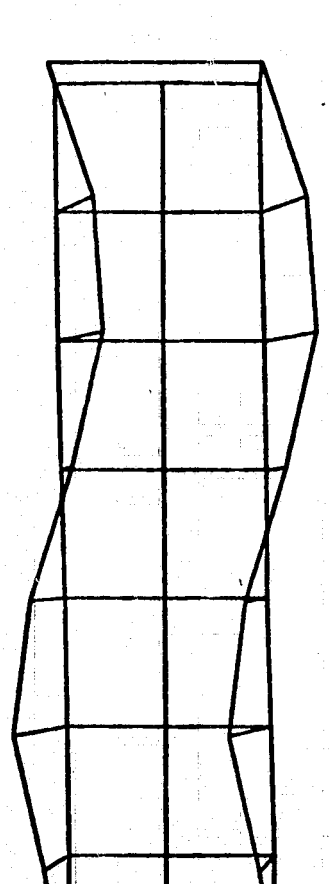
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH02
DATE = 06DE74

LEFT EYE VIEW



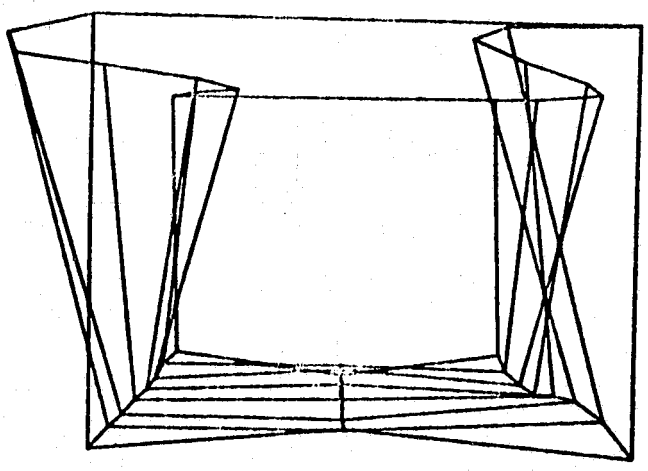
EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(10) = 20.20 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03
RUN NO. = ORTH02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.
DATE = 06DE74

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

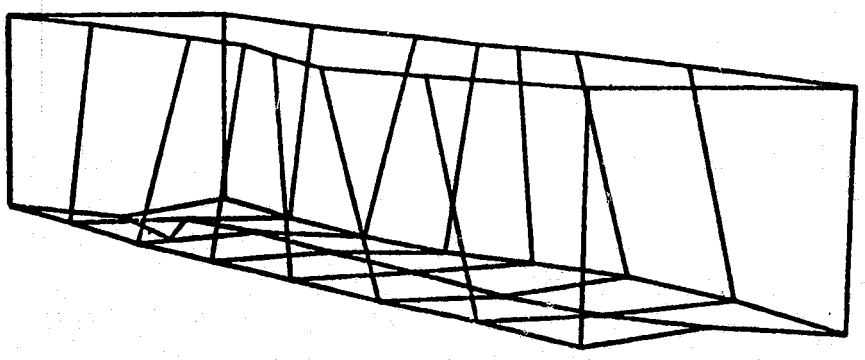
LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(10) = 20.20 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTH02	DATE = 06DE74	

LEFT EYE VIEW



EXPERIMENTAL MODE SHAPES,FULL TEST CAR MF = .0, MODE(10) = 20.20 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y = -7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

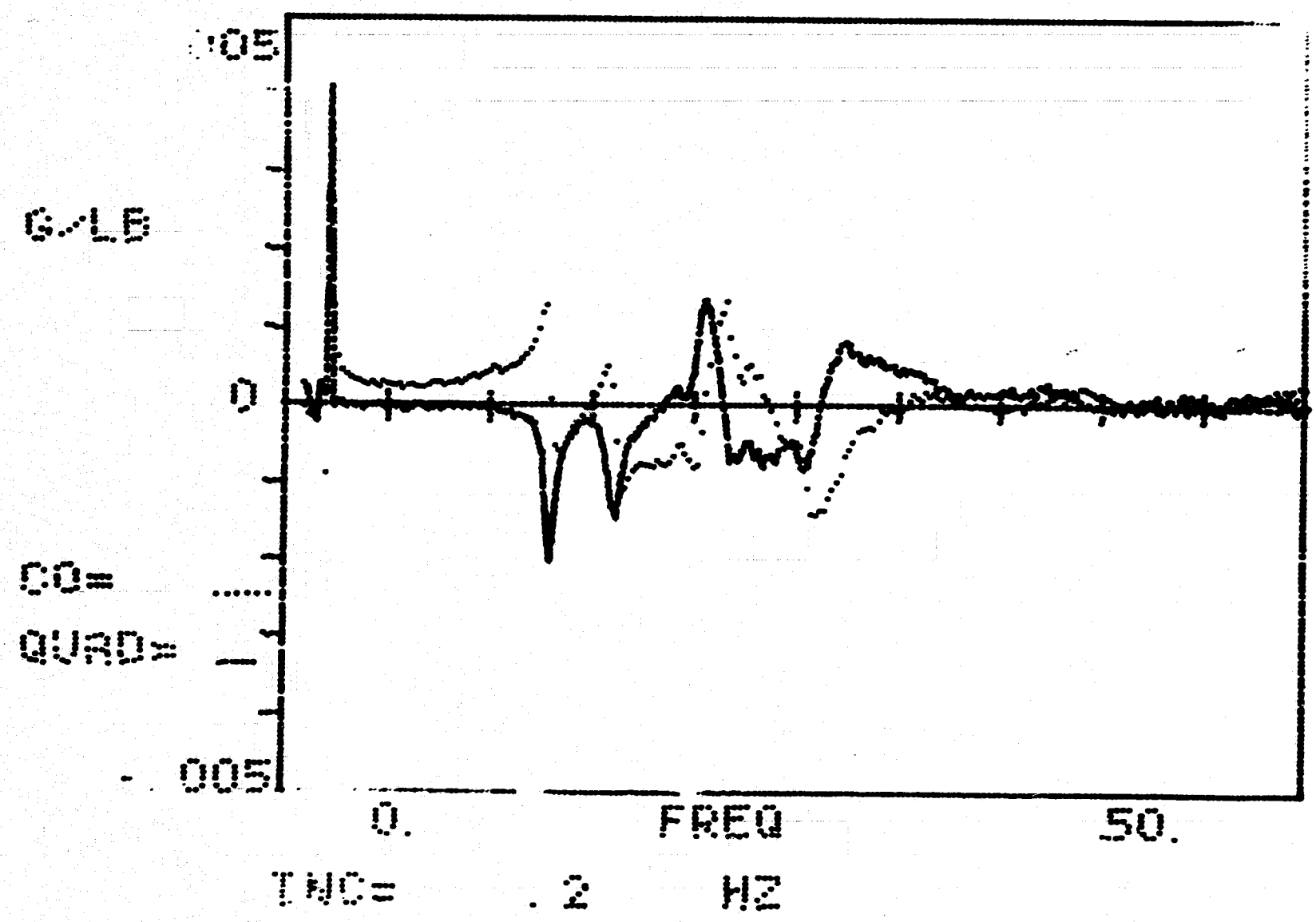
RUN NO. = ORTH02
DATE = 06DE74

APPENDIX C

CONFIGURATION 3, SYSTEM TEST TEST DATA

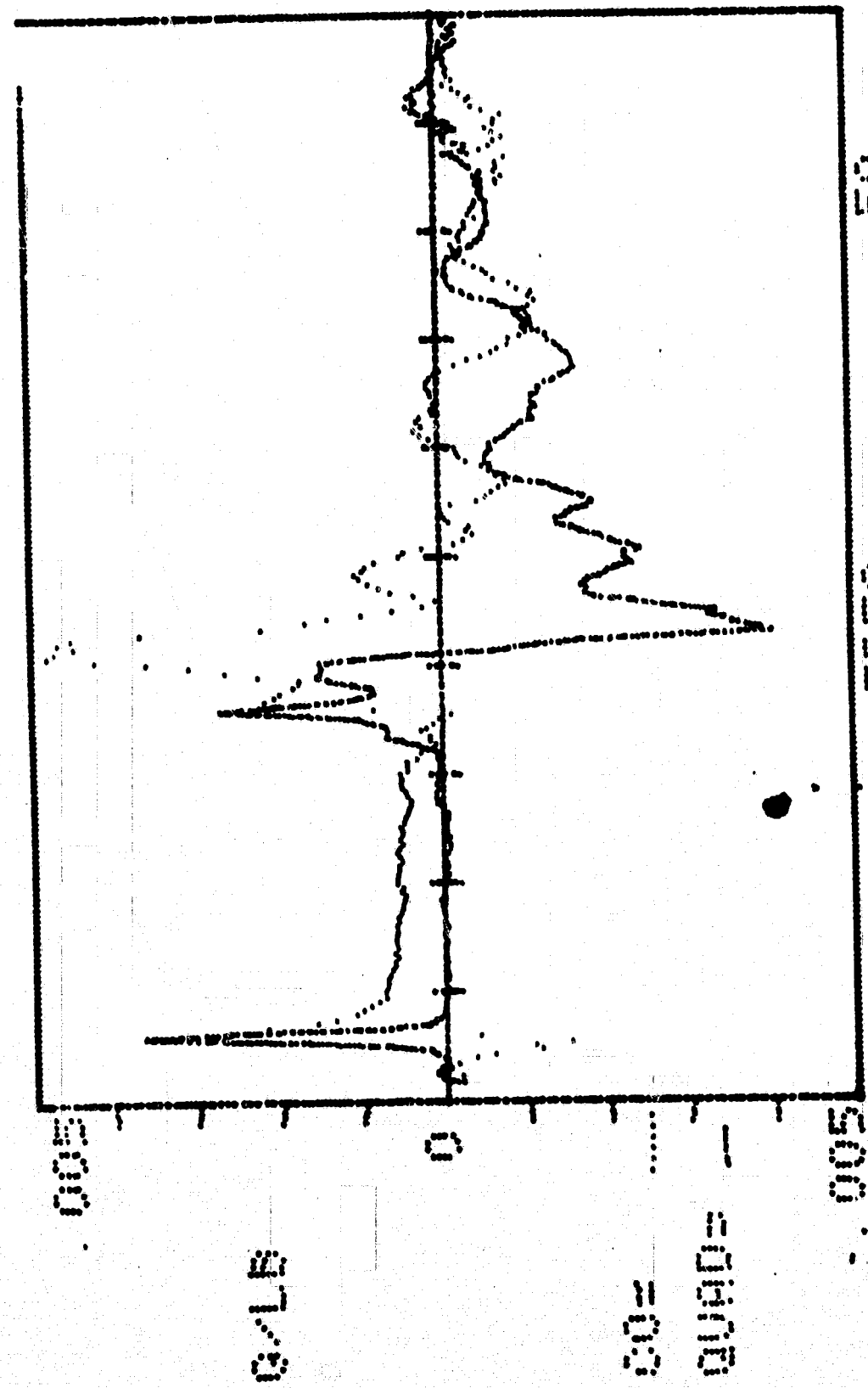
2.126 HZ
MODE

ORIGINAL PAGE IS
OF POOR QUALITY



TRK TRN 11-22-74 RUN 40 WB
AV12/F 3

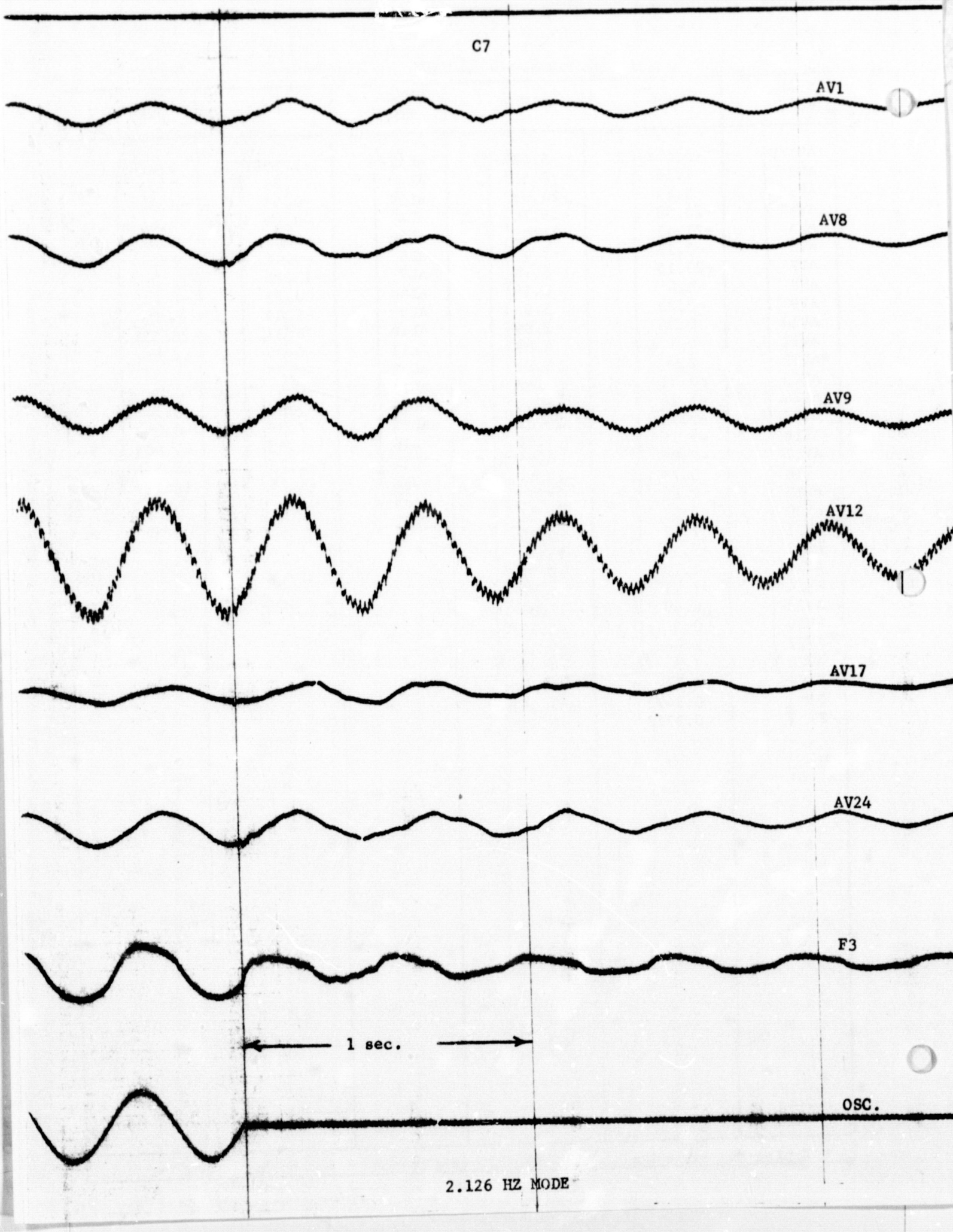
C4


-60.
-40.
-20.
0.
20.
40.
60.
dB
FREQ IN KHZ
0.
50.

2.126 HZ MODE

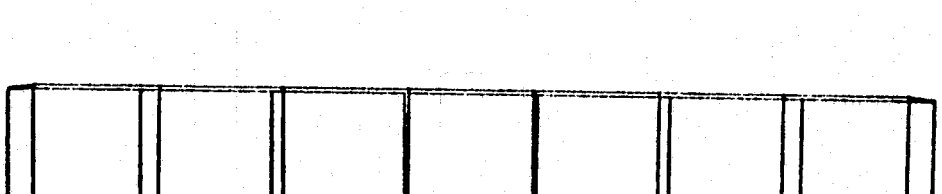
MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-5.41E-03	-5.58E-03	AL1/F3	-1.19E-03	0.82E-03
AV2	1.16	-9.56	AL2	1.16	1.5
AV3	3.61	-20.69	AL3	0.55	-1.33
AV4	-23.58	-15.76	AL4	-0.29	7.65
AV5	-21.43	21.33	AL5	-2.01	4.92
AV6	-0.12	-5.65	AL6	-6.06	5.38
AV7	-20.15	5.18	AL7	-15.26	-18.0
AV8	-3.4	6.59	AL8	0.75	-0.81
AV9	-3.23	5.9	AL9	-5.49	-35.73
AV10	0.06	3.89	AL10	6.37	-26.55
AV11	-0.121	4.89	AL11	-6.34	47.96
*AV12	2.08	4.94	AL12	-0.05	-5.65
AV13	-0.11	2.37	AL13	-6.61	41.64
AV14	-1.14	5.52	AL14	-2.37	-5.24
AV15	-3.13	6.82	AL15	7.89	-0.71
AV16	-3.19	6.69	AL16	5.33	42.88
AV17	-2.86	6.35	AL17	-1.78	28.59
AV18	0.75	-13.11	AL18	-1.16	-12.1
AV19	-0.68	7.75			
AV20	-1.91	36.64			
AV21	7.52	-5.79			
AV22	-1.5	-15.3			
AV23	-1.13	-8.39			
AV24	-1.11	4.98			
AV25	6.49	-10.89			
AV26	0.5	-3.76			
AV27	1.68	-2.44			
AV28	-1.5	-8.91			
F1/F3	-0.77	1.342			
F5	0.8473	-0.5537			
F7	0.2718	-0.9564			

* Tuning Measurements - AV12, F3 = 16 lb-pk



2.126 HZ MODE

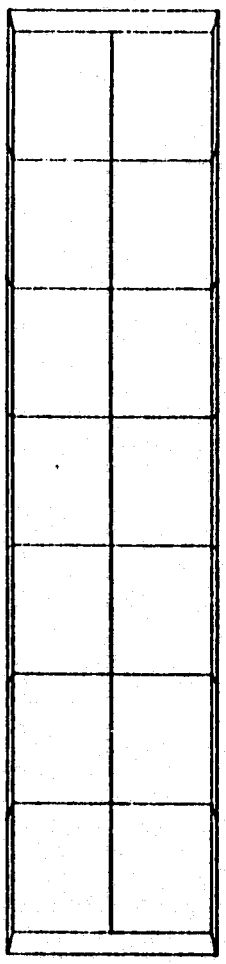
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-2.00000000E+03	Y = 0.	EYE TO EYE = 3.0 IN
Z = 1.50000000E+02	Z = 0.	
RUN NO. = ORTH03	DATE = 02JA75	

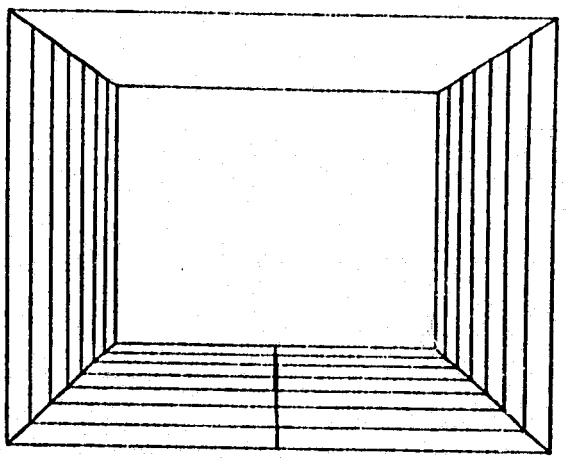
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+03	Z = 0.	
RUN NO. = ORTH03	DATE = 02JA75	

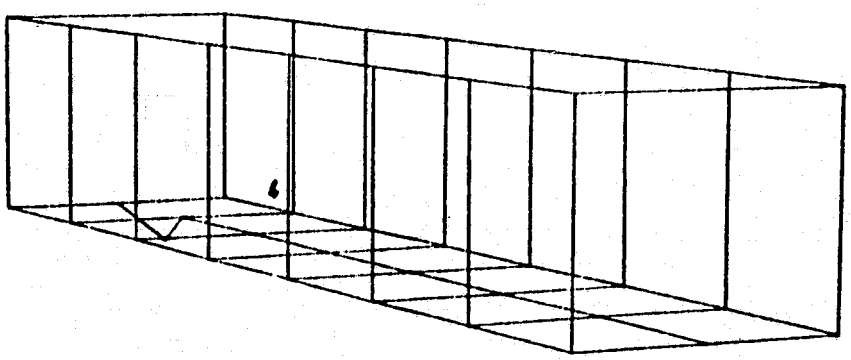
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTHO3	DATE = 02JA75	

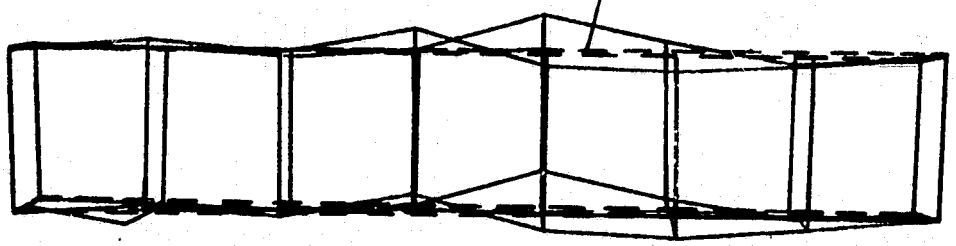
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS UNDEFLECTED MODEL

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.50000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-7.00000000E+02	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+02	Z = 0.	
RUN NO. = ORTH03	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(1) = 2.13 HZ

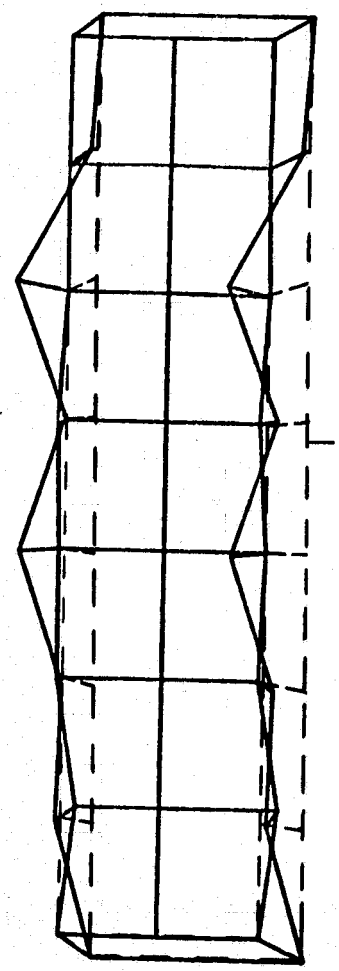
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = -2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF =

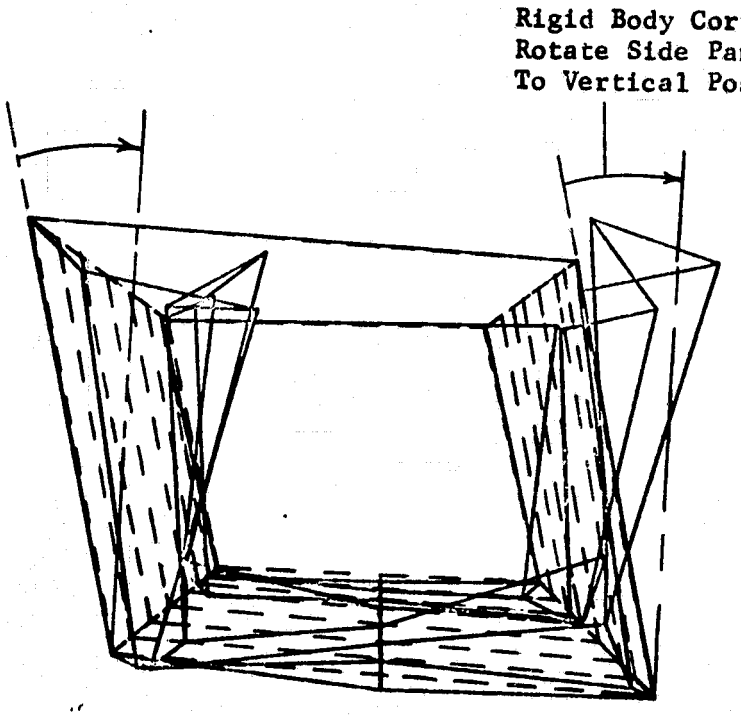
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

RUN NO. = ORTH03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

DATE = 02JA75

MODE(1) = 2.13 HZ
ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN



LEFT EYE VIEW

EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(1) = 2.13 HZ

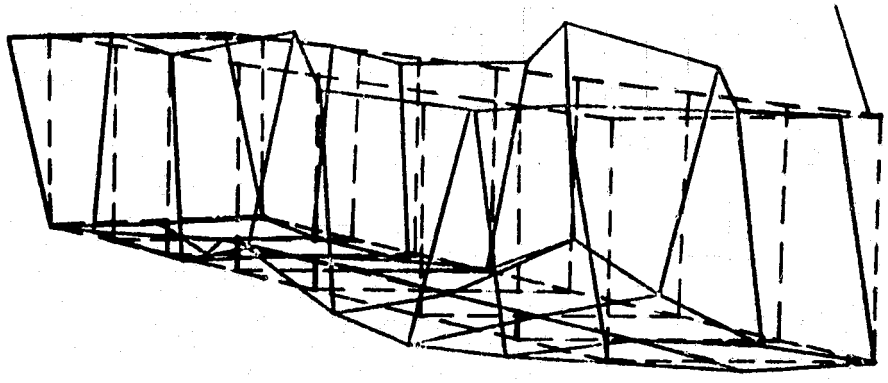
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(1) = 2.13 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

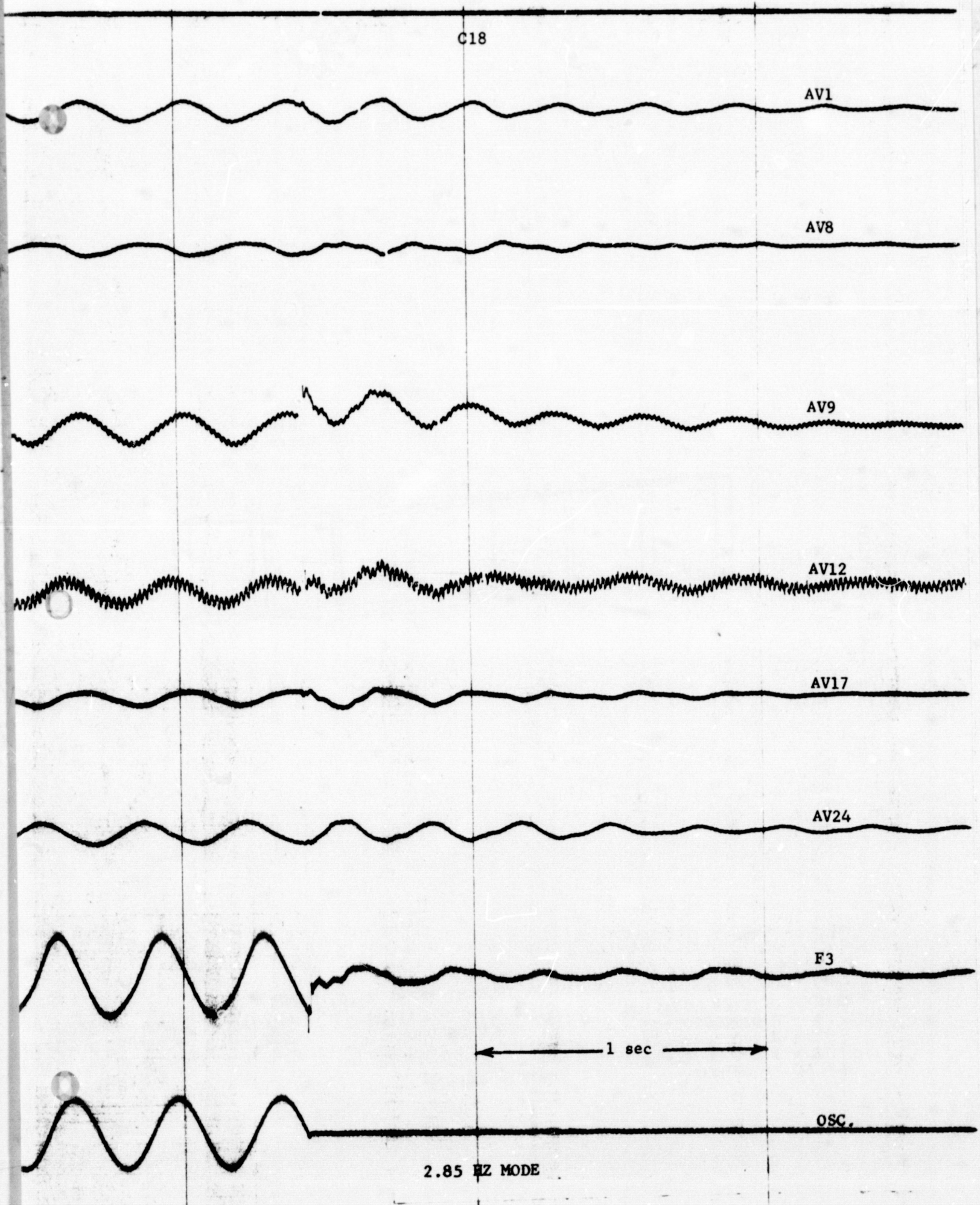
2.85 HZ
MODE

C17

2.85 HZ MODE

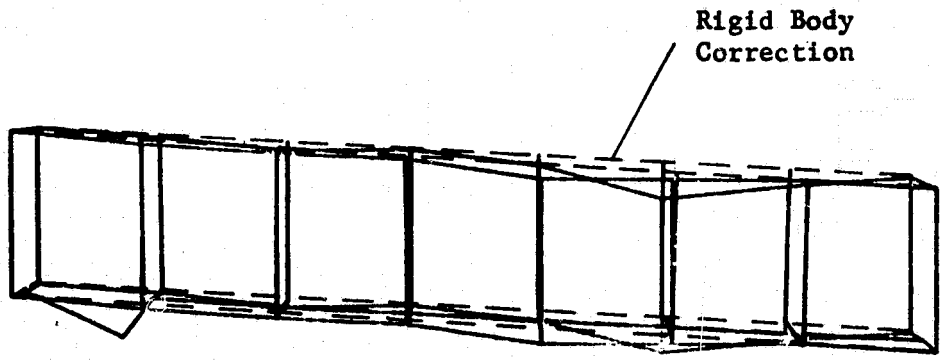
MEAS. NO's.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-0.96E-03	8.82E-03	AL1/F3	-2.4E-04	0.24E-03
AV2	-0.43	-6.31	AL2	-9.9	0.35
AV3	-1.38	-6.55	AL3	4.1	0.53
AV4	-0.61	-6.79	AL4	9.5	0.08
AV5	-4.23	-0.04	AL5	29.8	0.13
AV6	1.13	1.75	AL6	-2.1	0.32
AV7	-1.04	4.5	AL7	7.8	2.11
AV8	1.66	-8.51	AL8	0.6	0.17
*AV9	-1.93	6.9	AL9	23.0	1.84
AV10	-1.76	5.75	AL10	-59.7	-8.2
AV11	-0.72	3.1	AL11	48.5	3.66
AV12	-0.21	1.18	AL12	53.4	6.97
AV13	1.22	-1.09	AL13	1.6	-0.57
AV14	0.86	-3.24	AL14	-255.8	8.66
AV15	1.27	-5.77	AL15	-73.5	-3.67
AV16	3.32	-7.94	AL16	-15.8	0.46
AV17	-0.83	6.85	AL17	21.1	-3.76
AV18	1.6	-10.2	AL18	-6.2	-2.13
AV19	-1.79	-15.24			
AV20	5.19	-3.62			
AV21	-8.99	1.67			
AV22	-12.98	0.97			
AV23	-2.26	5.82			
AV24	2.31	-8.59			
AV25	1.01	-5.98			
AV26	-1.78	5.47			
AV27	1.38	-5.8			
AV28	-1.82	6.03			
F1/F3	1.138	0.1251			
F5	0.6417	1.015			
F7	0.3888	1.249			

*Tuning Measurements - AV9, F3 = 14 lb-pk



2.85 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(2) = 2.85 HZ

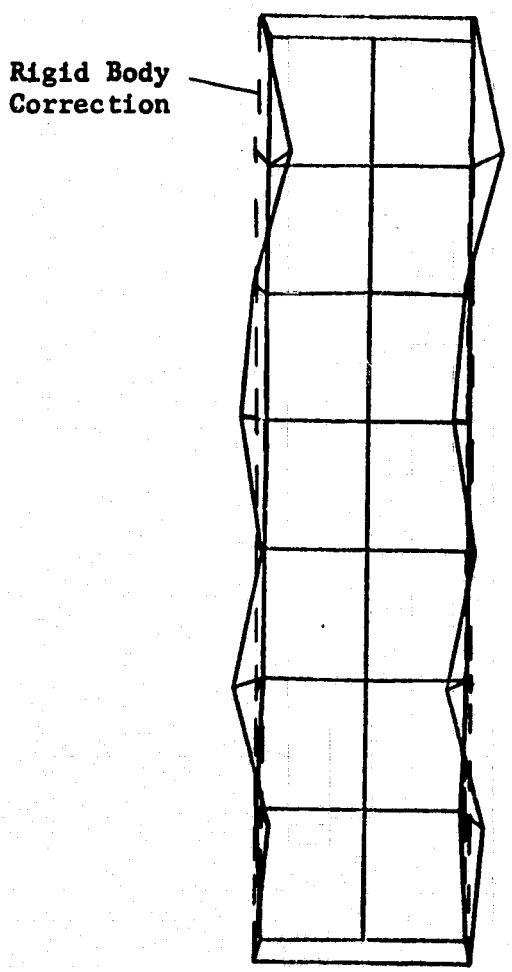
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = -2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



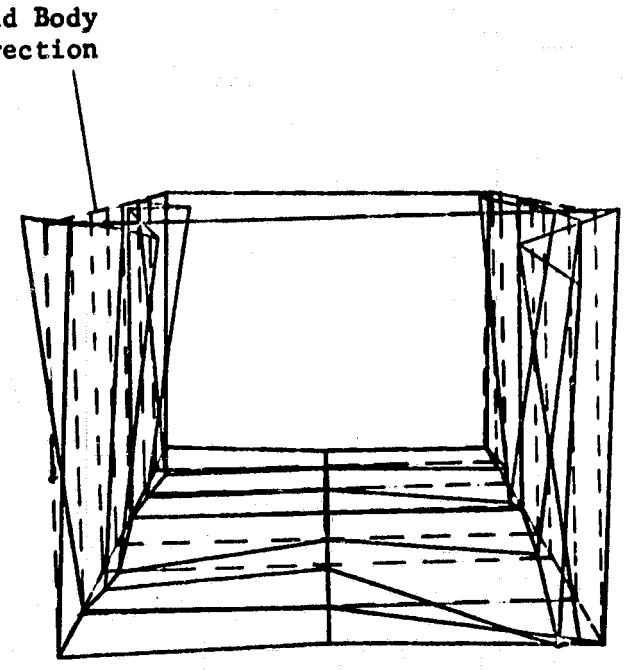
EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(2) = 2.85 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

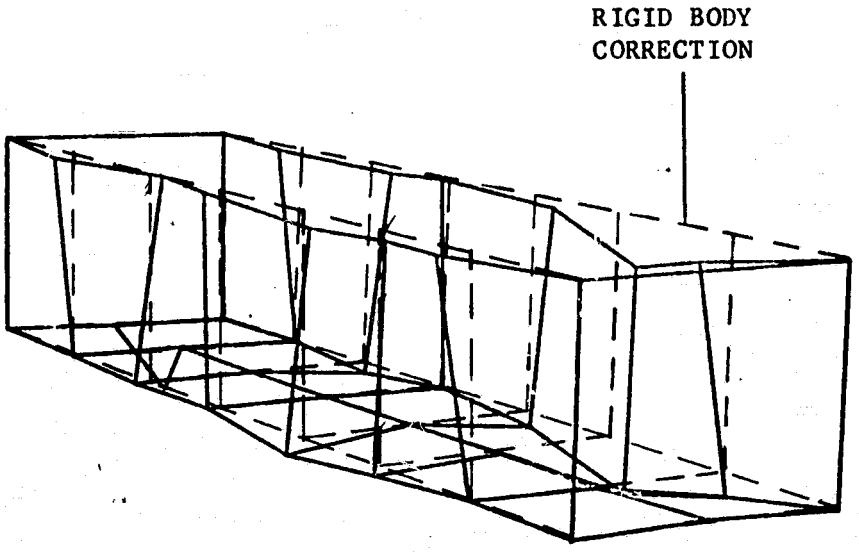


LEFT EYE VIEW

EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(2) = 2.85 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTHO3	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(2) = 2.85 HZ

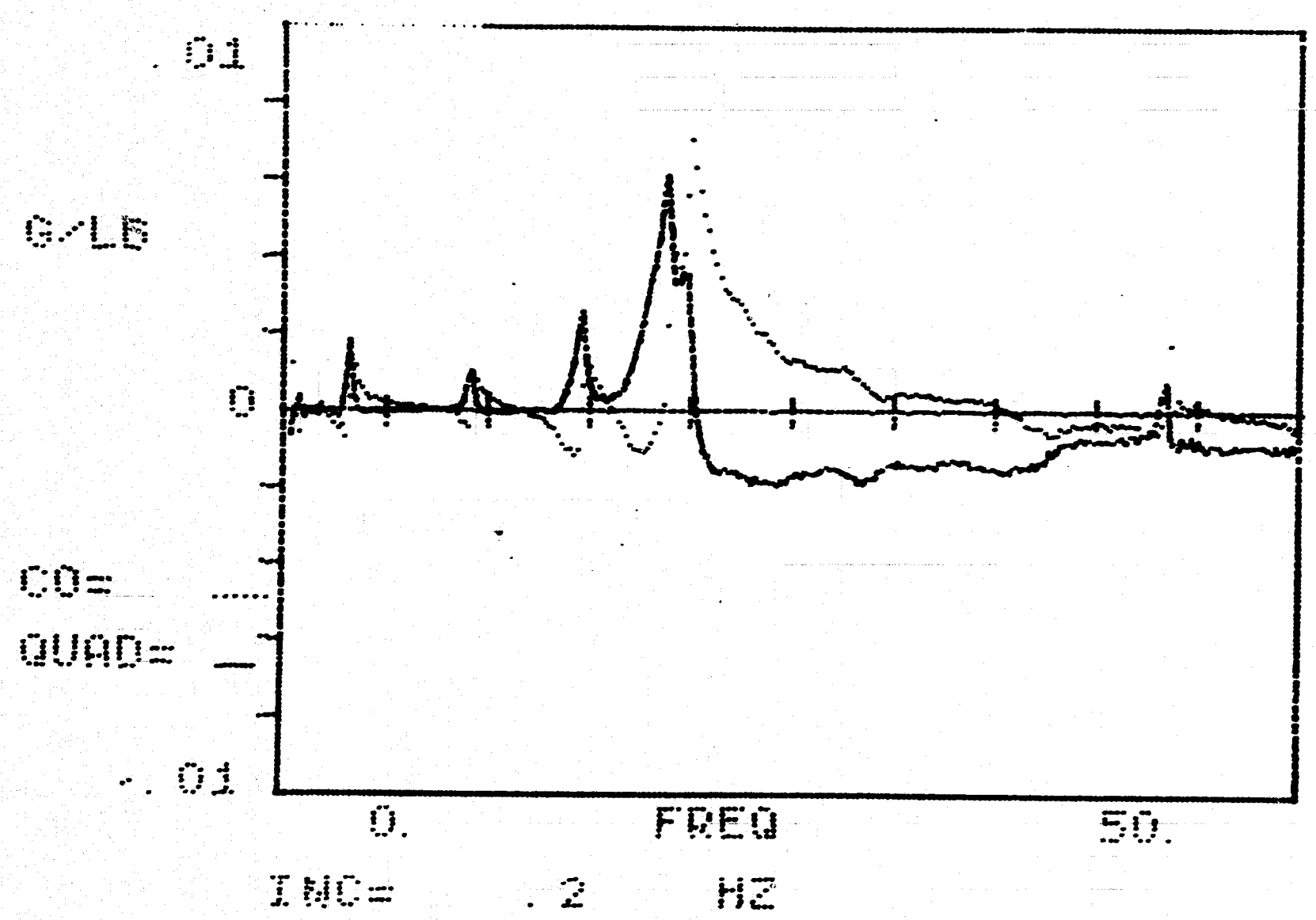
CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

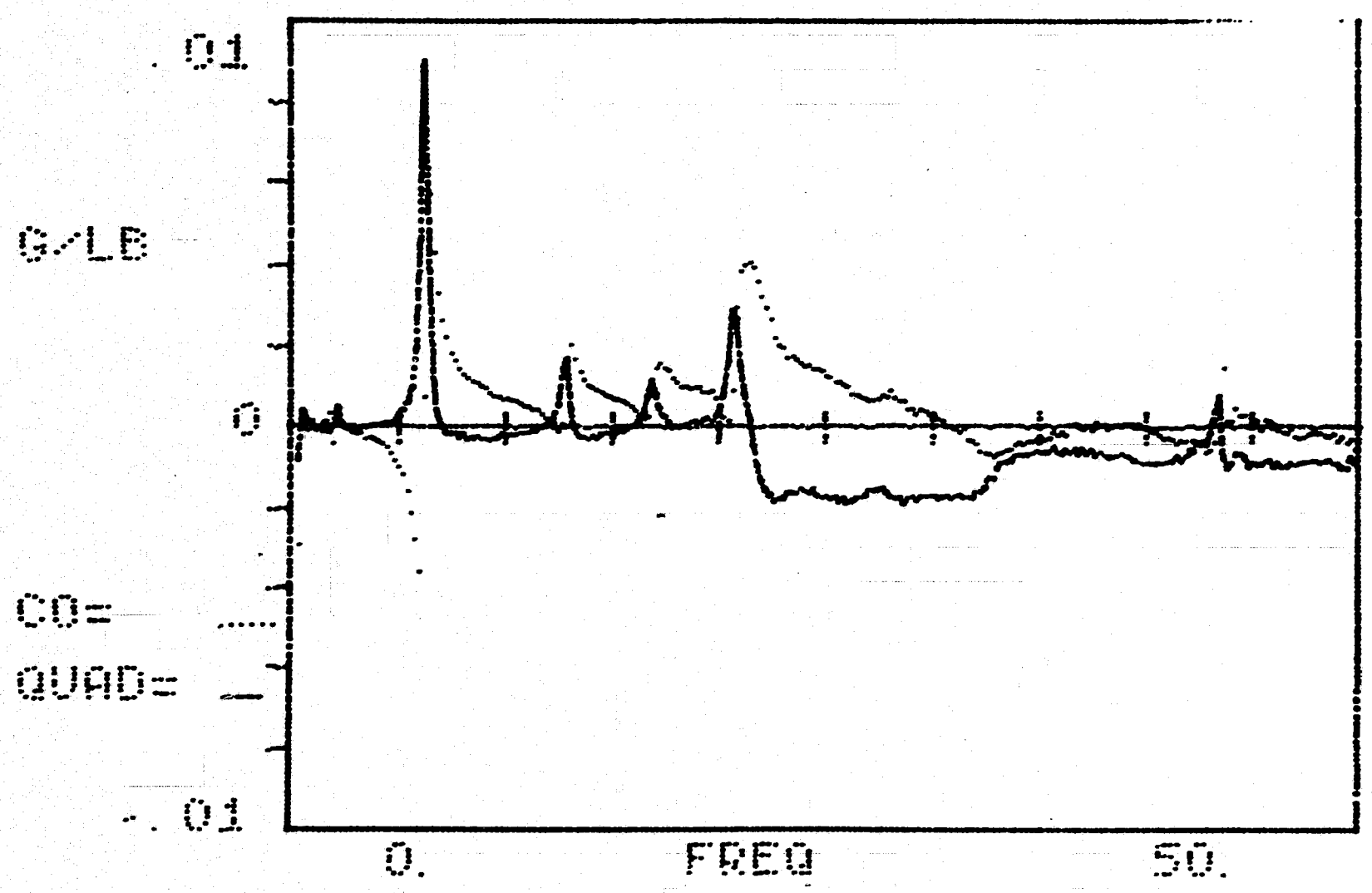
RUN NO. = ORTH03
DATE = 02JA75

3.15 HZ
MODE



TRK TRN 11-25-74 RUN 42 WB
AV17/F3

C24

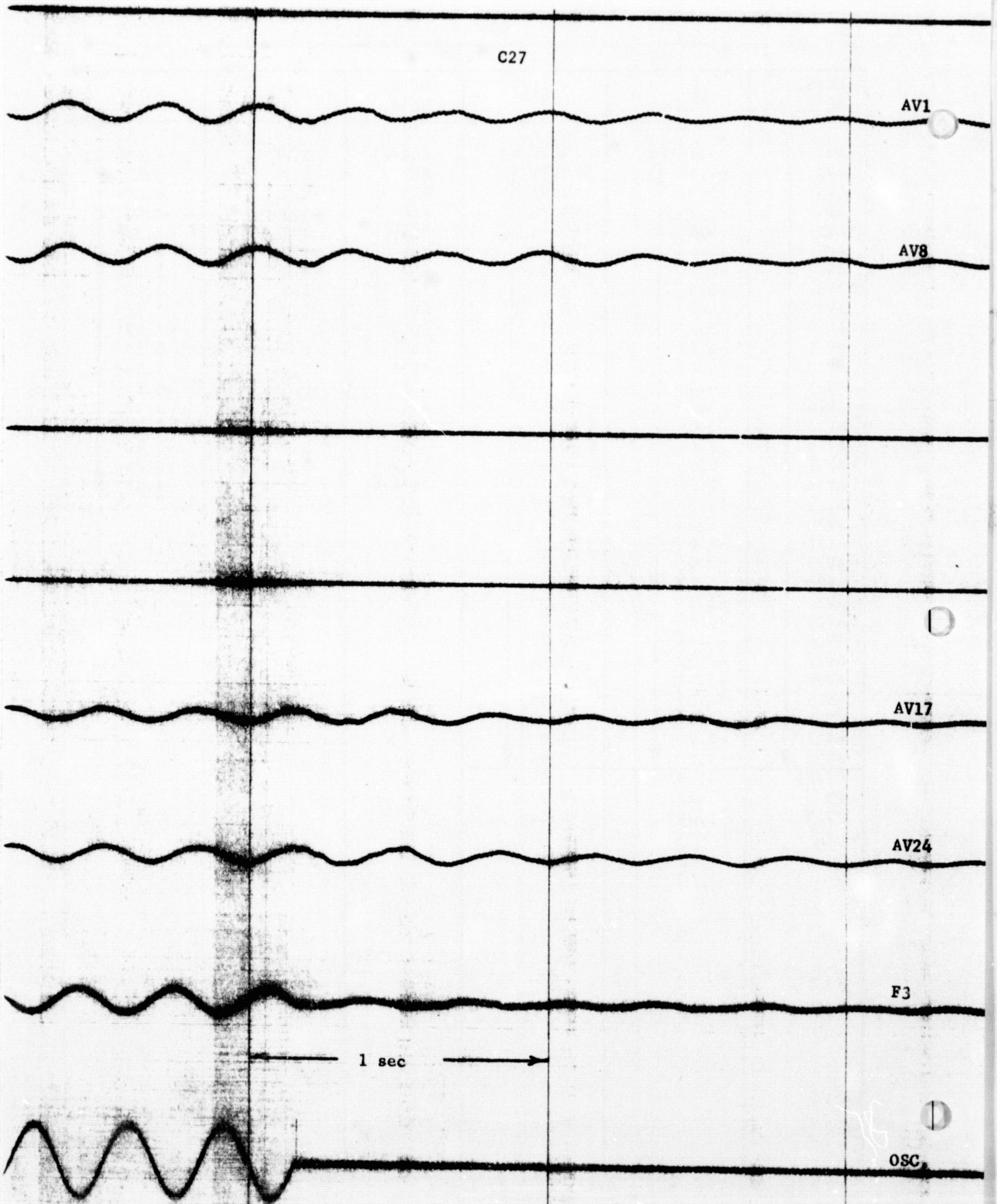

.01
G/LB
0
CO=
QUAD=
-.01
0.
FREQ
50.
INC= .2 HZ
TRK 7PM 11-25-74 RUN 43 MB
AU17/73

C25

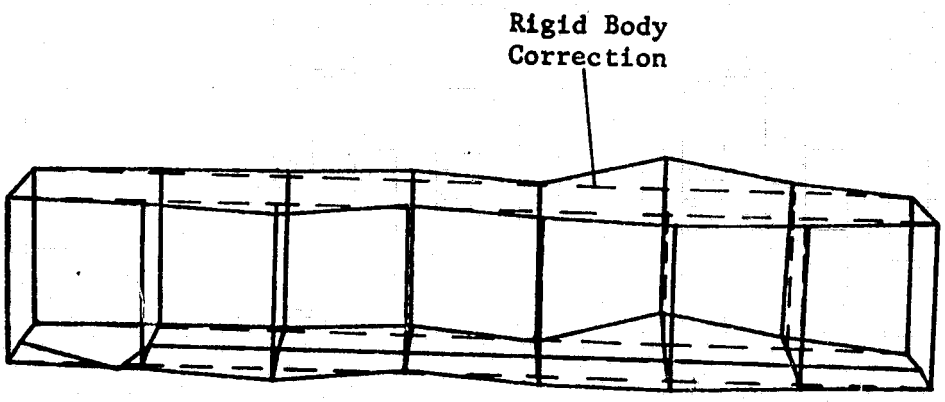
3.15 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	9.1E-04	1.2E-03	AL1/F3	3.2E-04	1.48E-03
AV2	-9.4	-1.71	AL2	8.7	3.47
AV3	11.9	-2.08	AL3	-6.3	0.88
AV4	-2.2	-1.79	AL4	-4.6	-0.83
AV5	-4.8	-0.91	AL5	6.3	2.35
AV6	-13.0	-2.18	AL6	9.2	0.93
AV7	-8.2	-1.5	AL7	-9.6	2.23
AV8	8.9	1.14	AL8	4.0	1.16
AV9	4.1	0.0	AL9	-2.5	1.16
AV10	3.7	-0.12	AL10	10.5	-1.92
AV11	4.0	-0.17	AL11	-4.1	-0.59
AV12	4.6	-0.21	AL12	19.3	1.06
AV13	4.4	-0.15	AL13	-8.6	-0.71
AV14	4.1	-0.22	AL14	-5.3	1.37
AV15	3.6	-0.19	AL15	-20.8	1.13
AV16	3.6	-0.22	AL16	12.2	-1.13
*AV17	0.6	-0.91	AL17	0.8	-0.26
AV18	9.6	2.11	AL18	22.6	-1.87
AV19	10.5	4.32			
AV20	5.1	1.17			
AV21	-8.0	2.20			
AV22	-2.9	1.7			
AV23	-4.1	1.62			
AV24	-1.6	-1.37			
AV25	-4.0	-0.7			
AV26	-2.8	-0.77			
AV27	-2.3	0.44			
AV28	-1.4	0.68			
AV29	-4.3	-0.35			
AV30	-4.2	-0.25			
AV31	-7.2	-1.0			
AV32	-1.8	0.96			
F1/F3	1.252	0.3478			
F5	1.121	-0.2792			
F7	1.349	0.446			

*Tuning Measurements - AV17, F3 = 85 lb-pk



3.15 HZ MODE



LEFT EYE VIEW

EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(3) = 7.15 HZ

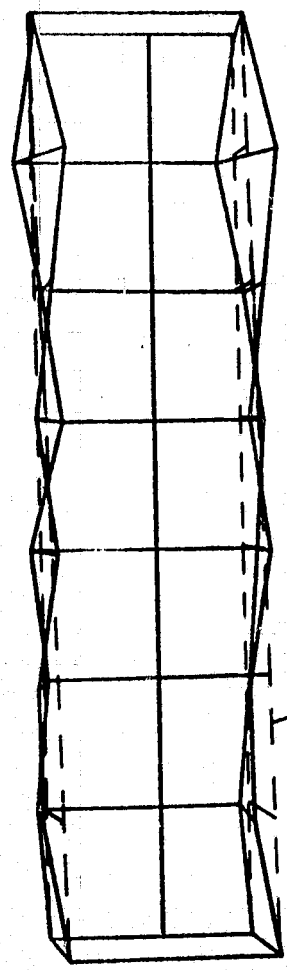
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = -2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = .0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW

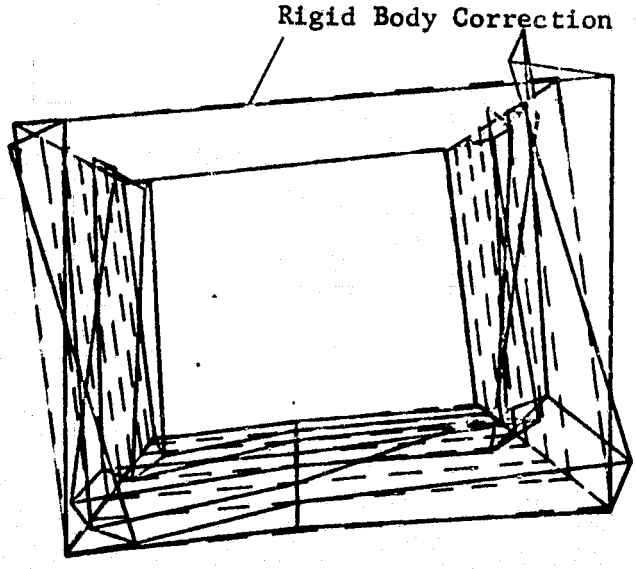


EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(3) = 3.15 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03
RUN NO. = ORTH03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.
DATE = 02JA75

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN



LEFT EYE VIEW

EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(3) = 3.15 HZ

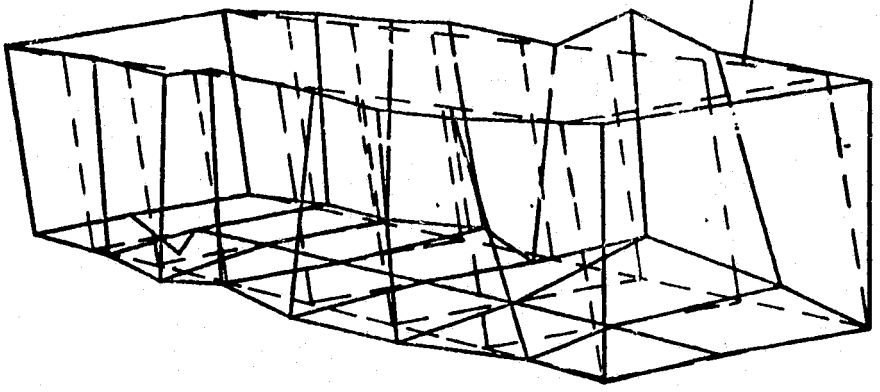
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

Rigid Body Correction



LEFT EYE VIEW

EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(3) = 3.15 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.50000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-7.00000000E+02	Y = 0.	CONE ANGLE = 20.0DEG
Z = 2.00000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH03	DATE = 02JA75	

6.3 HZ
MODE

6.16 HZ MODE

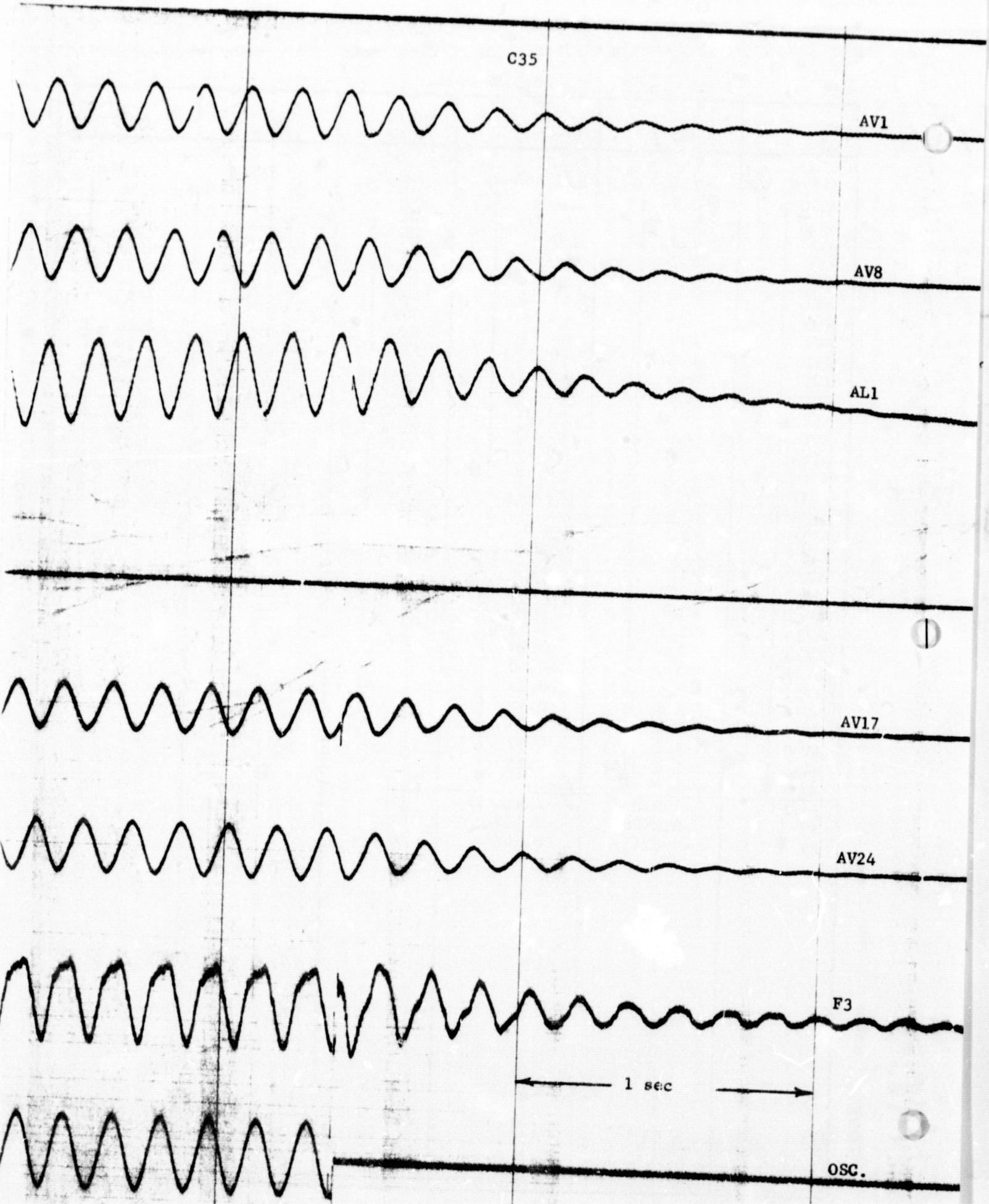
MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-4.3E-04	-12.52E-03	AL1/F3	-1.8E-04	-10.7E-03
AV2	-30.3	8.87	AL2	-9.7	-7.63
AV3	36.8	6.92	AL3	-8.9	-5.01
AV4	-45.9	-0.91	AL4	1.2	-1.0
AV5	9.6	-0.66	AL5	-4.3	1.28
AV6	20.9	-5.63	AL6	-5.6	3.93
AV7	-0.3	-9.25	AL7	-9.5	9.34
AV8	1.9	11.83	AL8	-7.0	10.4
AV9	-0.9	1.61	AL9	20.2	6.45
AV10	-1.7	1.85	AL10	-68.0	18.05
AV11	0.1	1.17	AL11	-19.9	9.49
AV12	0.3	0.49	AL12	6.0	0.01
AV13	2.7	-0.1	AL13	24.0	-2.51
AV14	1.0	-0.52	AL14	5.3	-7.51
AV15	2.0	-1.35	AL15	44.8	-11.25
AV16	3.6	-1.6	AL16	33.3	-3.57
*AV17	12.3	10.22	AL17	-4.7	-2.14
AV18	49.1	-8.49	AL18	-26.7	-1.41
AV19	13.4	-7.08			
AV20	1.1	-2.14			
AV21	-4.5	1.93			
AV22	-3.4	7.36			
AV23	-13.8	9.2			
AV24	-3.5	-12.9			
AV25	17.5	4.42			
AV26	-11.6	-5.98			
AV27	-12.1	-4.13			
AV28	2.1	4.81			
AV29	11.6	1.35			
AV30	10.0	0.68			
AV31	40.2	9.03			
AV32	-27.0	-8.86			
F1/F3	-2.7	0.9805			
F5	-0.621	-0.2721			
F7	-1.171	1.264			

*Tuning Measurements - AV17, F3 = 30 lb-pk

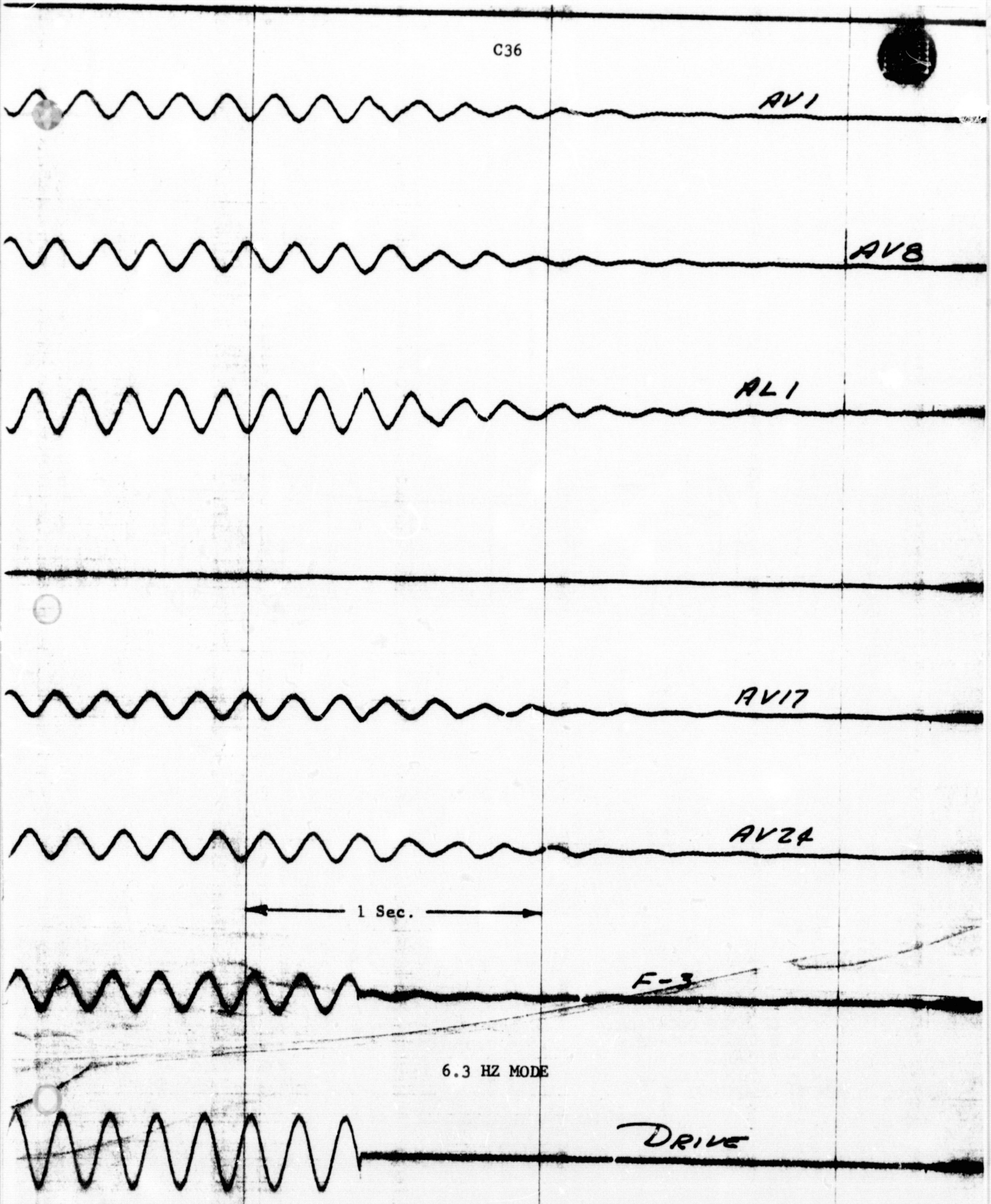
6.3 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-3.3E-04	1.44E-03	AL1/F3	-2.7E-04	-1.27E-03
AV2	3.2	1.1	AL2	-1.9	-0.34
AV3	4.3	0.72	AL3	1.9	-0.14
AV4	4.8	0.04	AL4	-4.7	0.31
AV5	8.7	-0.14	AL5	-6.7	0.30
AV6	8.1	-0.81	AL6	-3.3	0.57
AV7	3.6	-1.12	AL7	-4.2	0.92
AV8	-0.5	1.54	AL8	-3.5	1.22
AV9	0.0	0.17	AL9	-5.1	0.16
AV10	0.4	0.2	AL10	-1.0	1.29
AV11	0.4	0.11	AL11	-1.7	0.34
AV12	1.2	0.06	AL12	0.0	0.19
AV13	0.3	-0.03	AL13	2.5	-0.24
AV14	1.0	-0.07	AL14	3.7	-1.07
AV15	1.0	-0.16	AL15	4.9	-1.27
AV16	0.7	-0.19	AL16	4.3	-0.71
*AV17	2.9	1.21	AL17	-4.7	-0.2
AV18	-2.4	-1.12	AL18	2.8	0.41
AV19	-3.5	-0.92			
AV20	-2.7	-0.58			
AV21	-3.9	0.24			
AV22	-5.2	1.45			
AV23	-4.1	1.12			
AV24	2.1	-1.53			
AV25	0.6	0.46			
AV26	2.0	-0.63			
AV27	-0.4	-0.39			
AV28	-1.6	0.6			
AV29	0.4	0.24			
AV30	-0.2	0.12			
AV31	1.6	0.89			
AV32	-1.3	-0.89			
F1/F3	-1.012	-2.36E-02			
F5	0.8908	-0.1487			
F7	-0.8713	0.1624			

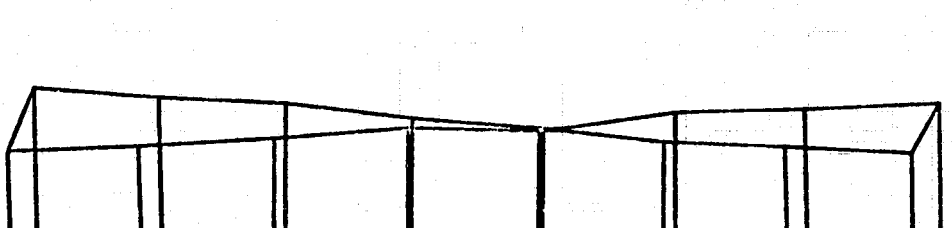
*Tuning Measurements - AV17, F3 = 136 lb-pk



6.16 HZ MODE


AV1
AV8
AL1
AV17
AV24
1 Sec.
F-3
6.3 HZ MODE
DRIVE

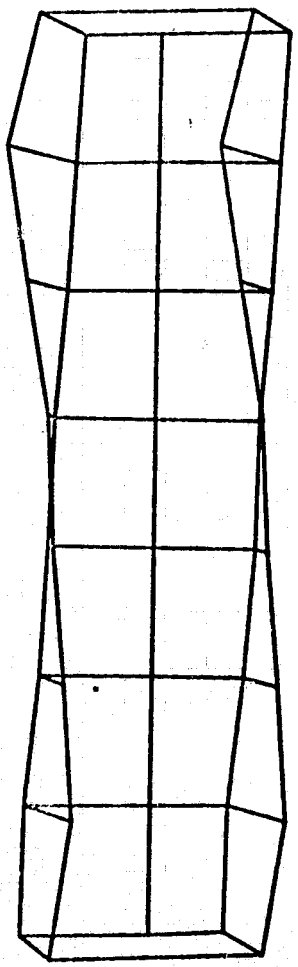
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(4) = 6.16 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 2.03000000E+02	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-2.00000000E+03	Y = 0.	CONE ANGLE = 20.0DEG
Z = 1.50000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH03	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(4) = 6.16 HZ

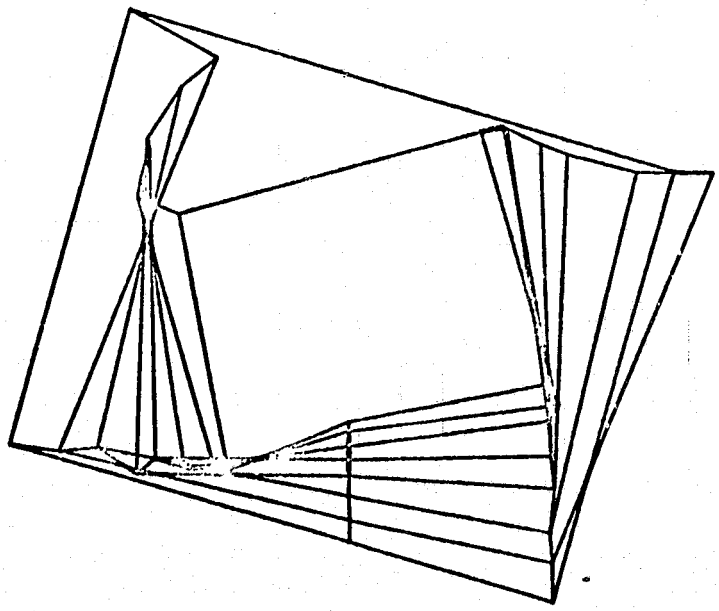
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(4) = 6.16 HZ

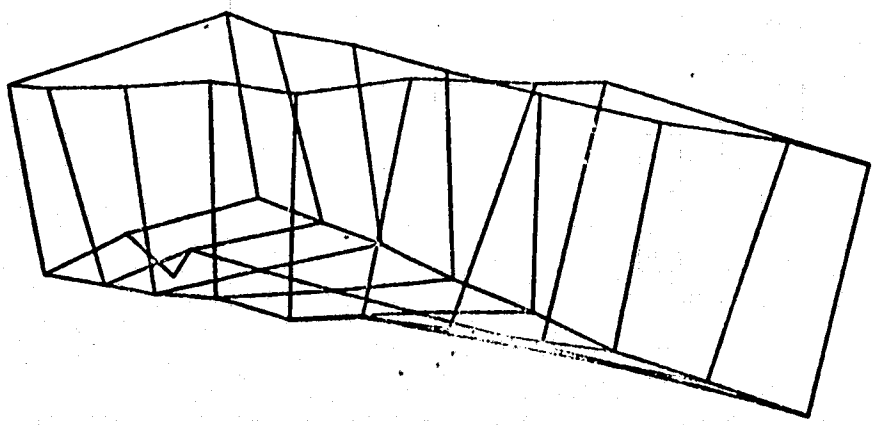
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(4) = 6.16 HZ

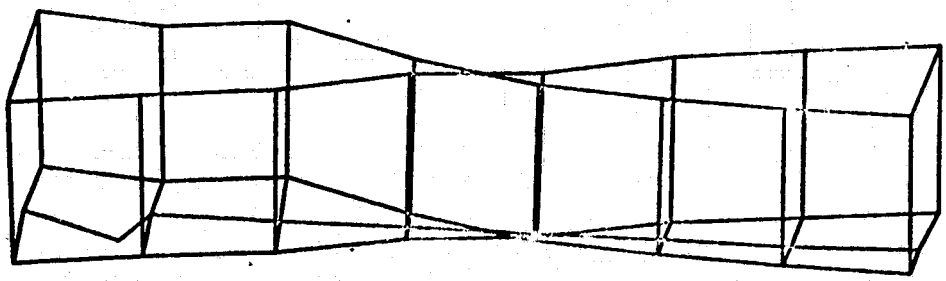
CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .2, MODE(5) = 6.30 HZ

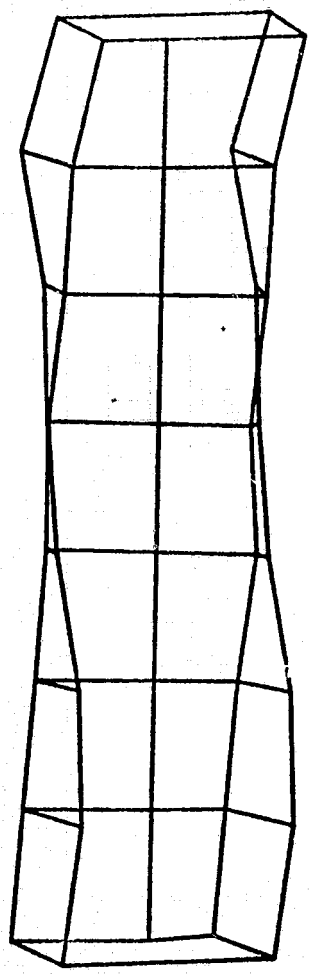
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT. MODE SHAPES, FULL TEST CAR ON TRUCKS MF = .2, MODE(5) = 6.30 HZ

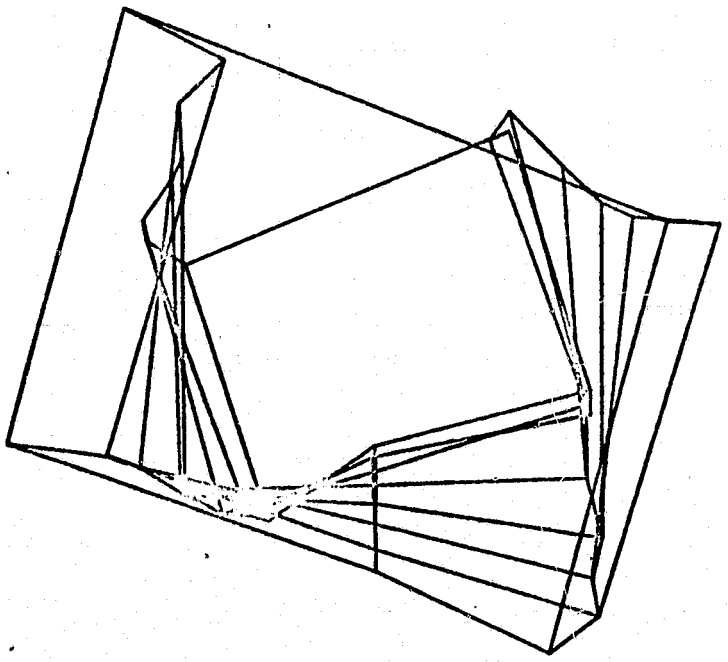
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .2, MODE(5) = 6.30 HZ

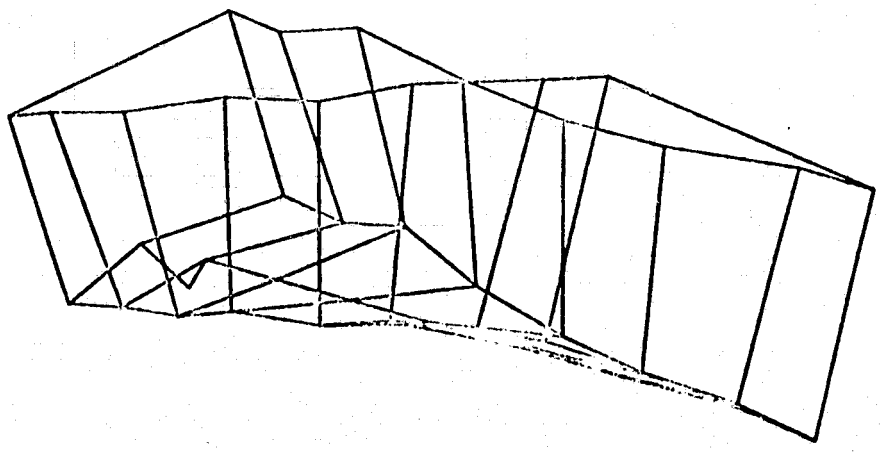
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .2, MODE(5) = 6.30 HZ

CENTER OF EYES LOCAT
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

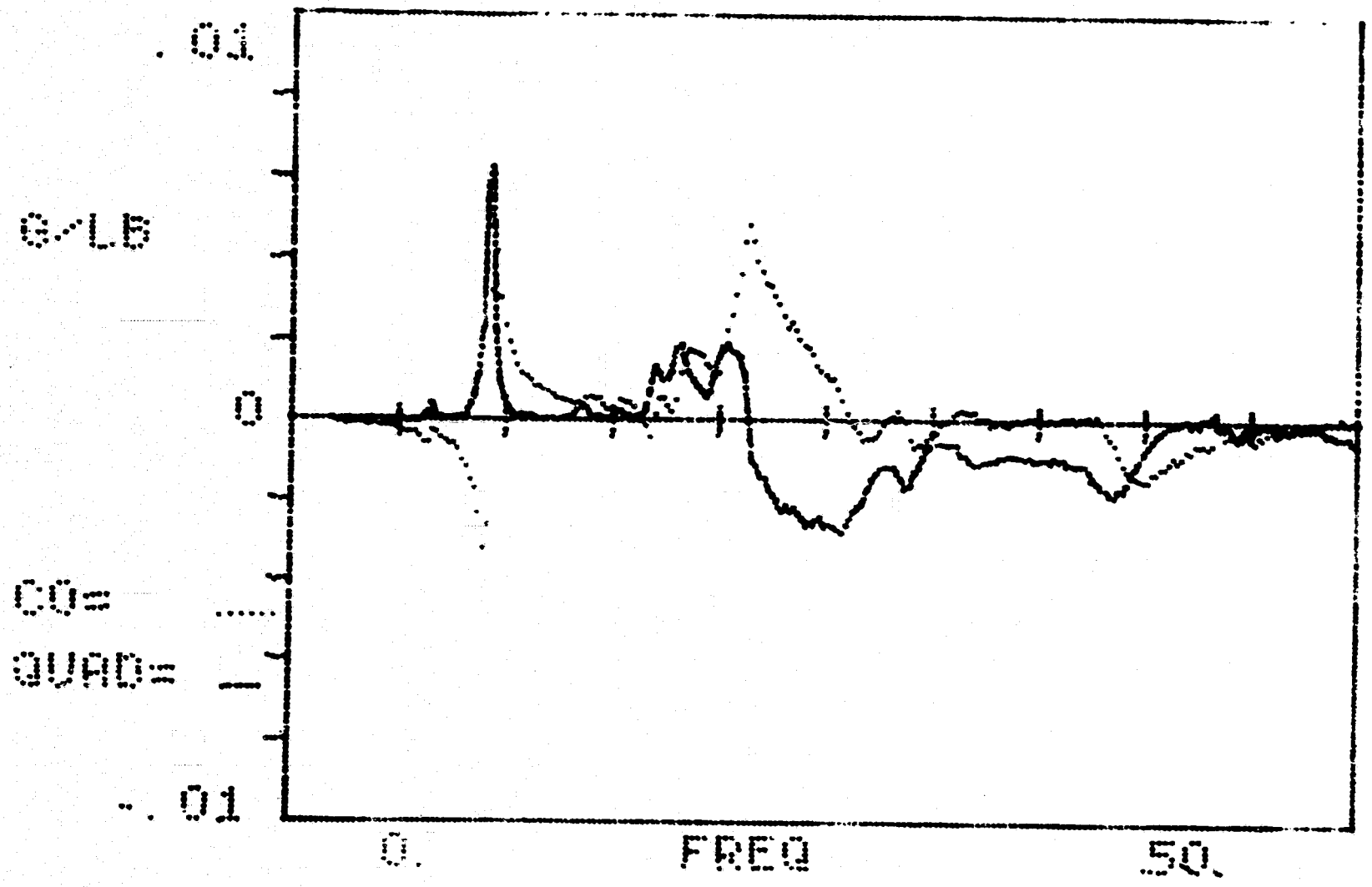
ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

6.31 HZ
MODE

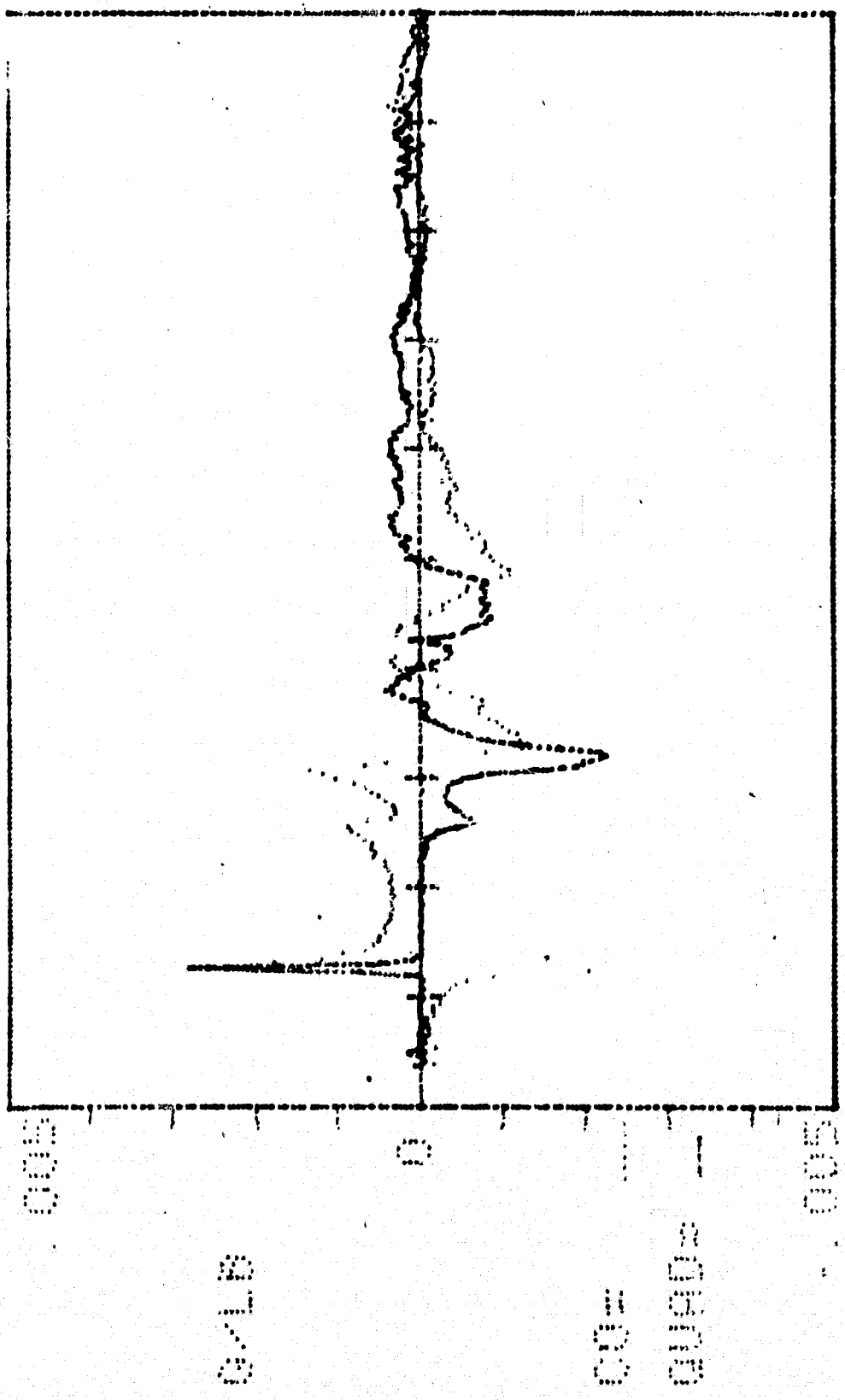
ORIGINAL PAGE IS
OF POOR QUALITY

LE
0
QUAD=
-.01
0.
FREQ
50.
INC= .2 HZ
K TRN 11-15-74 RUN 36 WB
UQ/F3



9K TRN 11-15-74 RUN 36 WB
AVG-F3

BK IRM 11-15-74 RUN 37 WB
AV12-F3


-80
0
80
-40
40
dB
dB
dB
dB
dB
dB

6.31 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	4.3E-04	2.01E-03	AL1/F3	-1.7E-04	-2.2E-04
AV2	-2.5	-2.66	AL2	-4.3	2.2
AV3	3.3	-3.17	AL3	0.0	-2.3
AV4	8.7	-2.46	AL4	-1.5	0.8
AV5	-6.0	-2.83	AL5	0.3	-3.0
AV6	4.5	-3.55	AL6	0.0	-0.3
AV7	4.4	-2.24	AL7	-0.6	-2.3
AV8	2.3	1.67	AL8	0.4	0.0
AV9	2.5	1.84	AL9	-6.2	2.7
AV10	2.6	2.05	AL10	-0.1	-4.6
AV11	3.4	2.91	AL11	0.8	-3.8
*AV12	3.5	3.23	AL12	-2.9	-3.5
AV13	3.5	3.13	AL13	1.1	-0.9
AV14	3.1	2.75	AL14	-2.7	-2.7
AV15	1.6	1.76	AL15	0.6	3.1
AV16	0.9	1.29	AL16	-3.7	0.1
AV17	5.6	1.94	AL17	-35.7	-20.1
AV18	0.1	-2.84	AL18	7.5	-14.0
AV19	-3.0	-3.76			
AV20	-4.7	-3.48			
AV21	-3.2	-3.33			
AV22	-2.1	-2.90			
AV23	-1.0	-2.15			
AV24	2.4	1.66			
F1/F3	0.9782	-1.582E-02			
F5	0.9862	-0.1454			
F7	0.9743	-0.164			

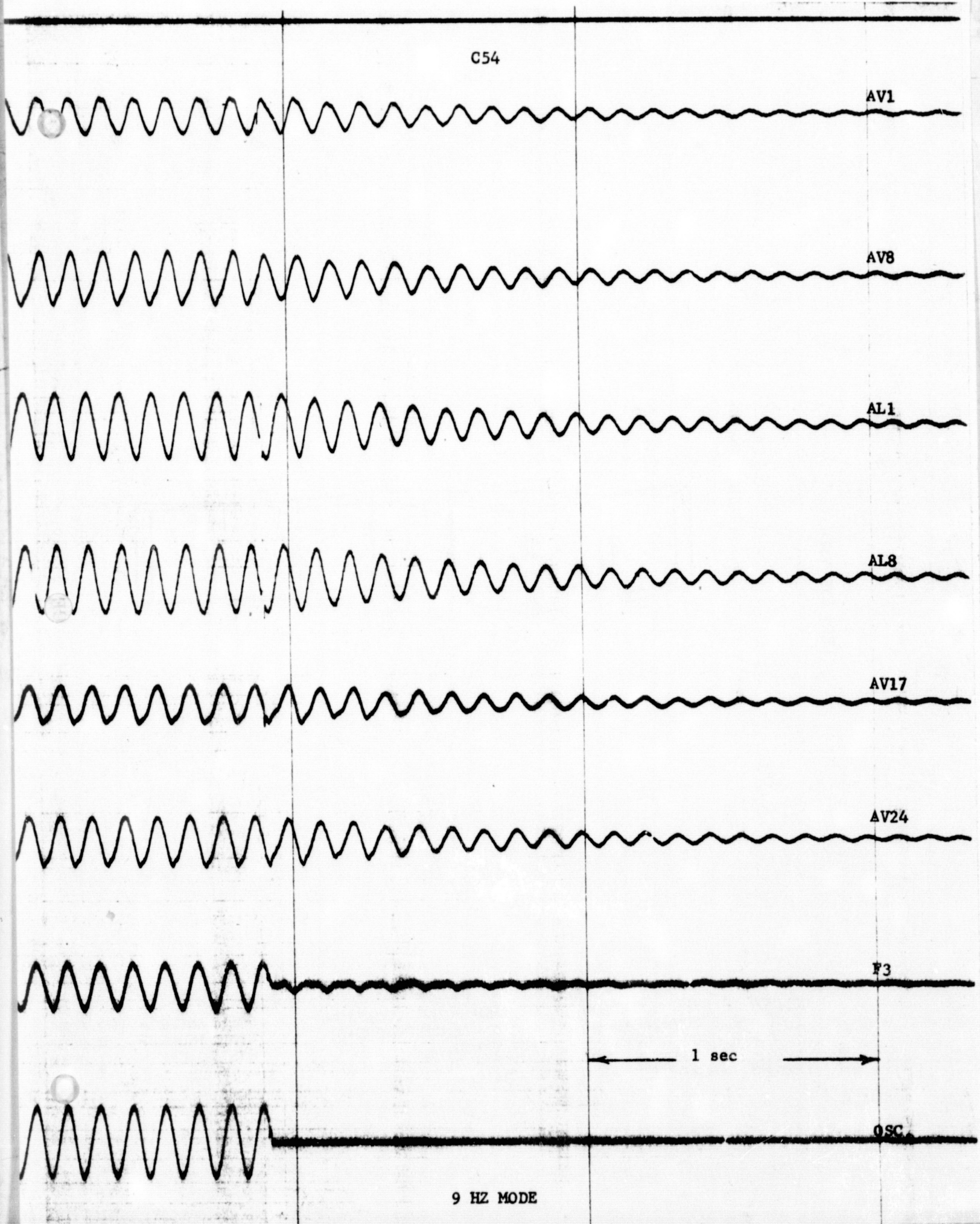
*Tuning Measurements - AV12, F3 = 190 lb-pk

9.0 HZ
MODE

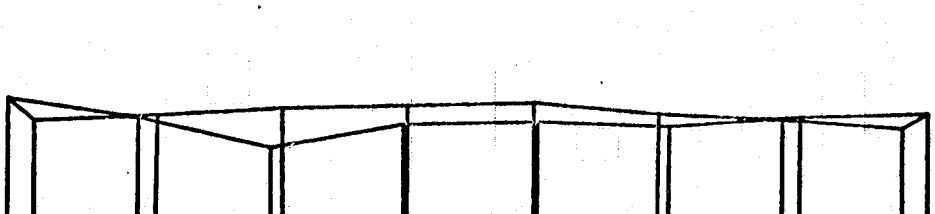
9.0 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-0.7E-04	-1.83E-03	AL1/F3	-2.6E-04	3.48E-03
AV2	1.2	0.78	AL2	1.3	2.21
AV3.	4.7	-0.94	AL3	-3.7	-0.59
AV4	5.5	-0.30	AL4	-3.7	-1.71
AV5	-2.0	-0.96	AL5	-4.0	-1.45
AV6	25.1	-5.42	AL6	-3.2	-0.4
AV7	-2.9	-0.63	AL7	-0.4	2.57
AV8	-1.5	-2.34	AL8	-0.4	3.5
AV9	-0.1	-0.01	AL9	3.3	6.82
AV10	0.4	-0.12	AL10	8.0	4.32
AV11	0.6	0.17	AL11	0.7	-2.1
AV12	0.8	-0.1	AL12	0.8	-7.67
AV13	0.5	-0.25	AL13	-3.1	-7.2
AV14	0.6	0.18	AL14	6.0	-0.75
AV15	0.4	0.09	AL15	7.7	5.45
AV16	0.1	0.33	AL16	5.1	6.51
*AV17	4.2	1.58	AL17	-7.2	2.9
AV18	-3.5	-0.4	AL18	0.1	-1.22
AV19	-7.5	0.6			
AV20	-4.3	2.26			
AV21	-5.4	1.49			
AV22	-0.9	0.7			
AV23	-2.9	-1.03			
AV24	3.9	2.3			
AV25	2.2	0.71			
AV26	2.2	0.74			
AV27	-2.1	-0.74			
AV28	-2.7	-1.01			
AV29	0.7	0.14			
AV30	1.0	0.33			
AV31	4.7	0.68			
AV32	-2.9	-0.55			
F1/F3	-1.033	3.357E-02			
F5	0.9729	8.864			
F7	-0.9597	-4.394			

*Tuning Measurements - AV17, F3 = 178 lb-pk


C54
AV1
AV8
AL1
AL8
AV17
AV24
F3
1 sec
OSC.
9 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(6) = 9.00 HZ

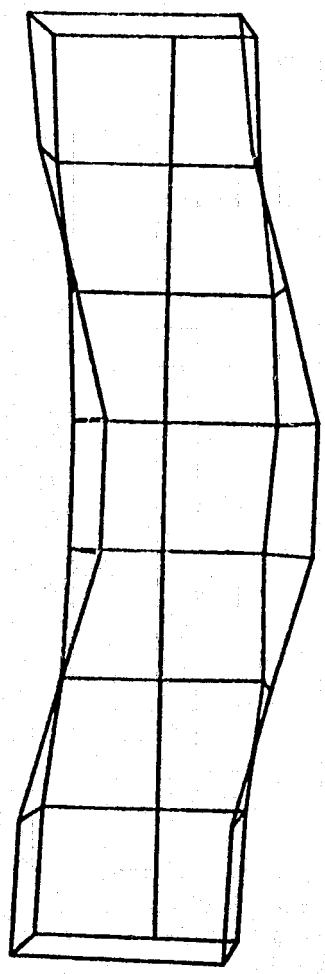
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(6) = 9.00 HZ

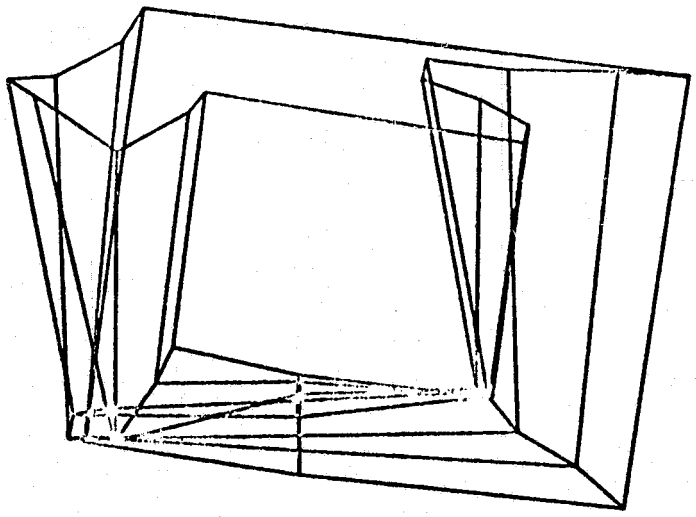
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



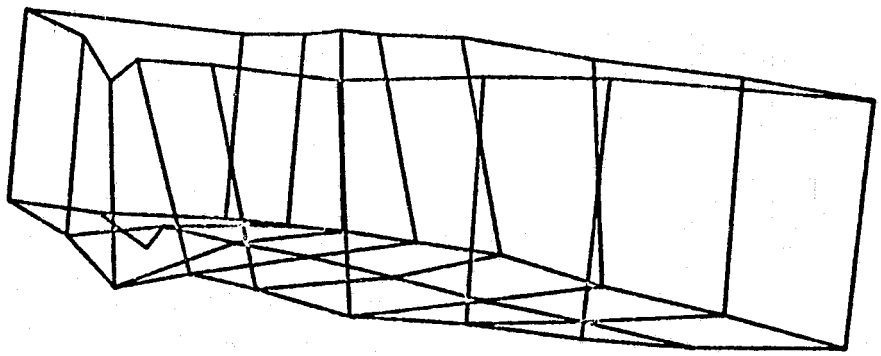
EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(6) = 9.00 HZ

CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75



LEFT SIDE VIEW

EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(6) = 9.00 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.50000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-7.00000000E+02	Y = 0.	CONE ANGLE = 20.0DEG
Z = 2.00000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH03	DATE = 02JA75	

12.56 HZ
MODE

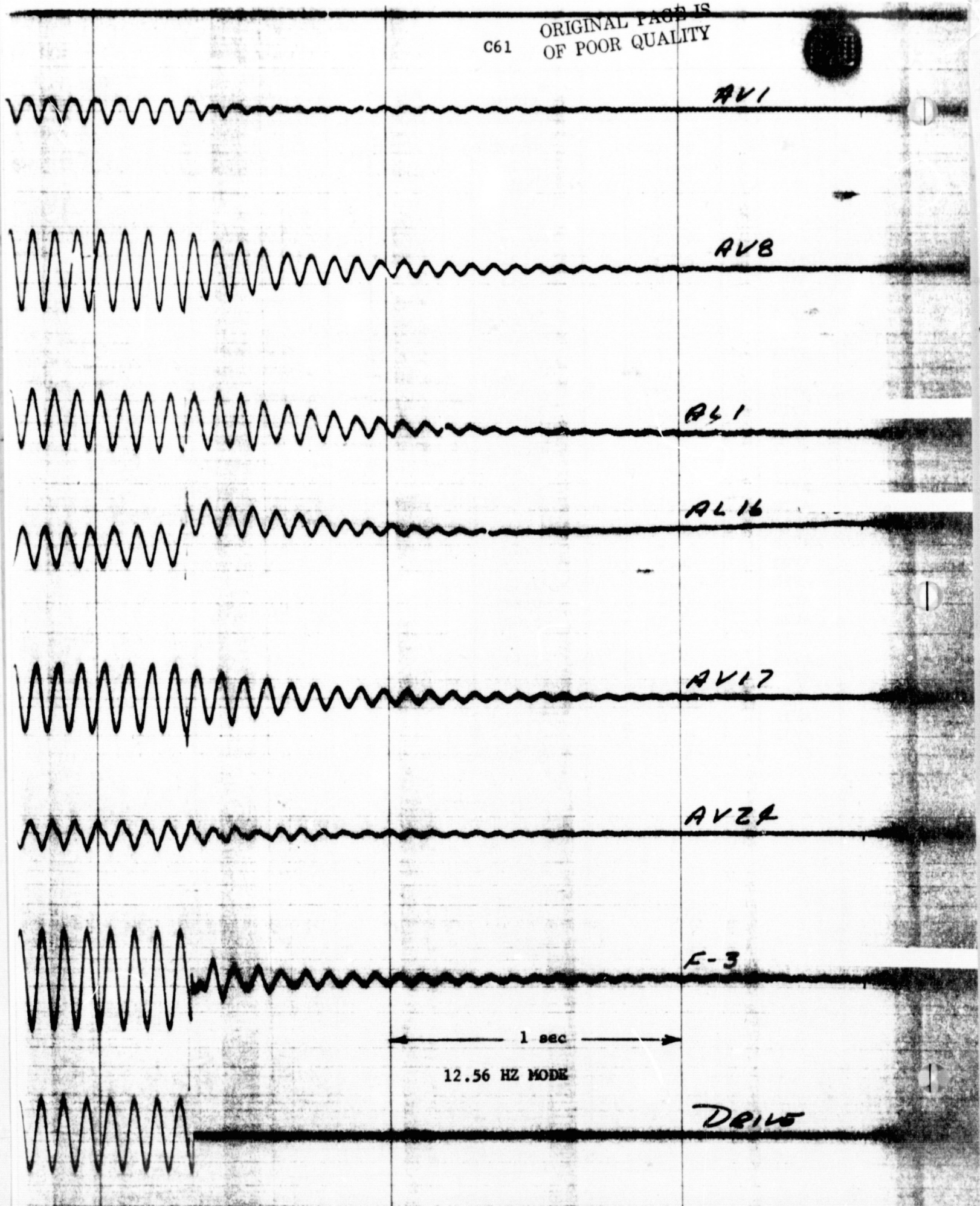
12.56 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-10.3E-04	0.69E-03	AL1/F3	-3.9E-04	1.5E-03
AV2	5.2	0.26	AL2	-3.6	0.93
AV3	0.2	0.58	AL3	-1.5	-0.53
AV4	-5.5	1.25	AL4	2.2	-0.75
AV5	-3.8	0.95	AL5	1.5	0.68
AV6	-13.8	2.29	AL6	3.1	0.83
AV7	-1.3	-1.34	AL7	3.6	-0.77
AV8	2.6	3.85	AL8	3.0	-1.69
AV9	-7.1	2.27	AL9	5.0	3.25
AV10	-1.8	0.96	AL10	7.5	-1.21
AV11	4.4	-0.51	AL11	2.0	-4.9
AV12	8.1	-1.35	AL12	-1.1	-1.99
AV13	7.4	-1.58	AL13	-0.7	2.35
AV14	3.6	-0.59	AL14	3.2	5.36
AV15	-3.0	0.76	AL15	-7.2	-0.64
AV16	-8.5	1.99	AL16	0.0	-4.19
*AV17	5.5	3.06	AL17	0.0	0.0
AV18	-3.4	-1.41	AL18	-2.0	-1.22
AV19	-9.4	0.67			
AV20	-7.1	1.36			
AV21	-5.5	0.98			
AV22	-1.9	0.35			
AV23	6.3	0.18			
AV24	-12.2	0.13			
AV25	5.4	-0.64			
AV26	1.3	-2.02			
AV27	2.7	-1.92			
AV28	7.1	-0.52			
AV29	5.6	-1.21			
AV30	4.6	-1.16			
AV31	6.6	-0.25			
AV32	-0.3	-1.7			
F7	0.9482	-1.298E-02			

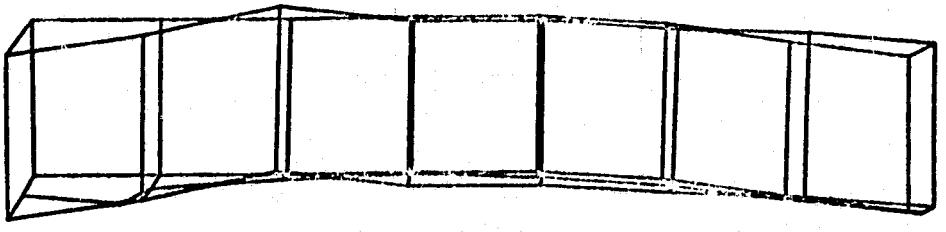
*Tuning Measurements - AV17, F3 = 161 lb-pk

ORIGINAL PAGE IS
OF POOR QUALITY

C61



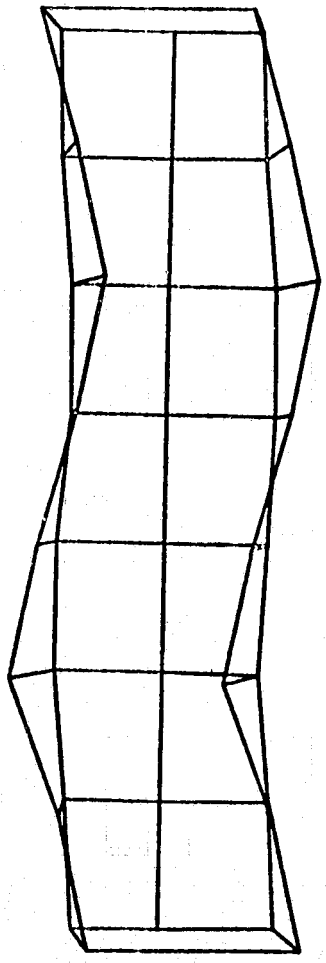
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(7) = 12.56 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 2.03000000E+02	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-2.00000000E+03	Y = 0.	CONE ANGLE = 20.0DEG
Z = 1.50000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTHO3	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(7) = 12.56 HZ

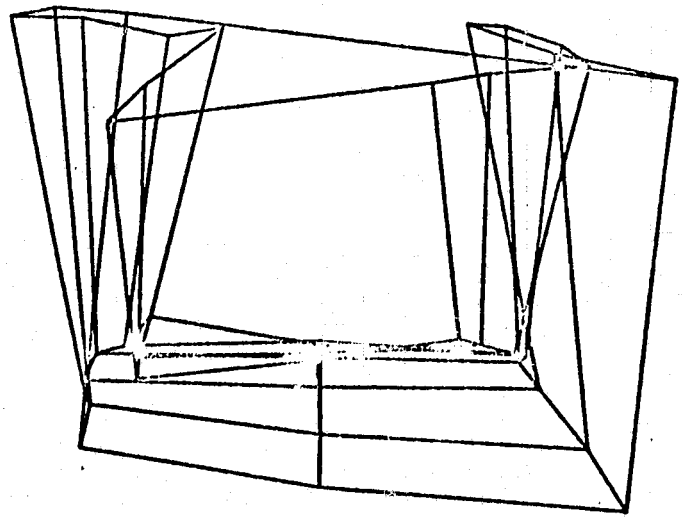
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW

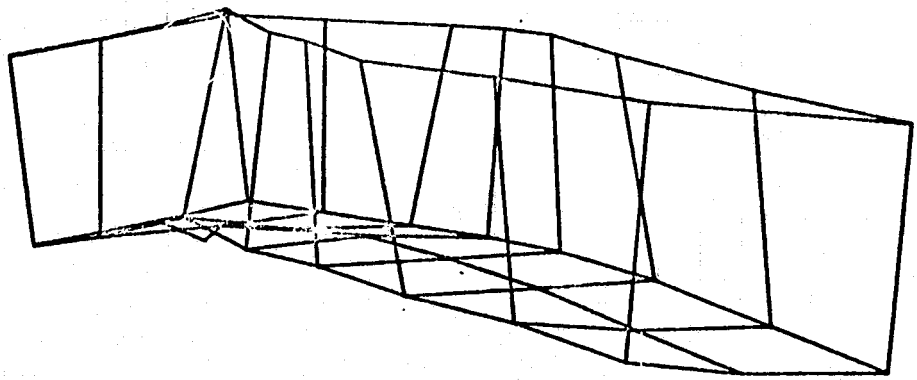


EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(7) = 12.56 HZ
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01
RUN NO. = ORTHO3

VIEW POI[illegible]CATION
X = 2.0[illegible]000E+02
Y = 0.
Z = 0.
DATE = 02JA75

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(7) = 12.56 HZ

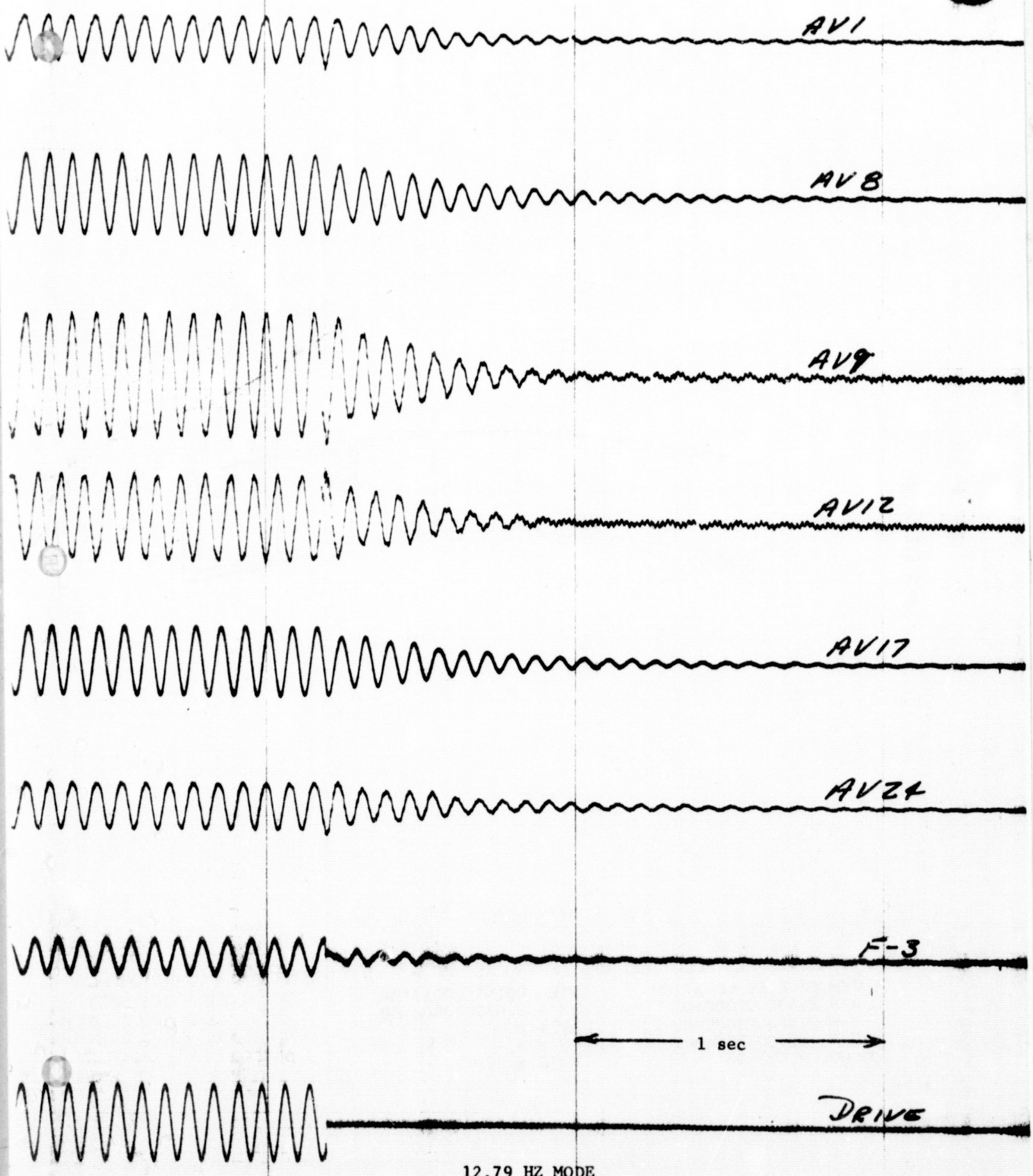
CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.50000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-7.00000000E+02	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+02	Z = 0.	
RUN NO. = ORTH03	DATE = 02JA75	

12.79 HZ
MODE

12.79 HZ MODE

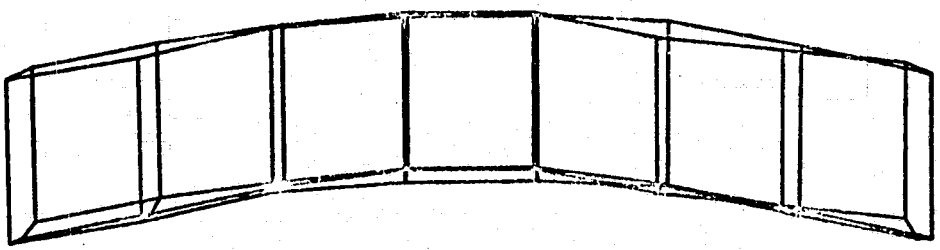
MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	4.0E-04	3.1E-03	AL1/F3	8.7E-04	-7.9E-04
AV2	0.4	-0.56	AL2	2.4	-4.7
AV3	-1.2	1.5	AL3	0.0	-1.8
AV4	3.0	2.03	AL4	3.0	-0.8
AV5	1.5	1.96	AL5	2.8	-3.2
AV6	5.7	1.03	AL6	4.6	0.8
AV7	-5.0	-1.63	AL7	-3.6	2.3
AV8	22.0	3.65	AL8	-9.4	8.5
AV9	8.9	3.84	AL9	0.0	0.0
AV10	6.0	1.52	AL10	-4.4	-10.4
AV11	1.5	-1.15	AL11	-29.8	7.5
*AV12	-0.4	-2.66	AL12	-18.3	-5.3
AV13	-2.9	-2.57	AL13	11.4	-12.3
AV14	0.8	-1.0	AL14	25.5	-14.9
AV15	3.2	1.58	AL15	-2.6	-15.7
AV16	6.0	4.0	AL16	-25.4	1.2
AV17	21.9	2.59	AL17	3.4	-7.1
AV18	-7.7	-1.41	AL18	-2.3	-4.9
AV19	13.1	-0.35			
AV20	1.7	2.05			
AV21	2.7	2.02			
AV22	-3.0	0.89			
AV23	5.5	-0.7			
AV24	-1.7	3.11			
AV25	-2.8	-1.91			
AV26	-7.3	-2.25			
AV27	-9.3	-2.18			
AV28	-0.6	-1.84			
AV29	-6.5	-1.95			
AV30	-6.3	-1.97			
AV31	-1.4	-1.51			
AV32	-10.0	-1.94			
F1/F3	0.7502	-0.6484			
F4	-1.87	0.2242			
F4A	-1.743	0.2373			
F5	0.4969	-0.5978			
F7	0.699	0.2329			

*Tuning Measurements - AV12, F3 = 136 lb-pk



12.79 HZ MODE

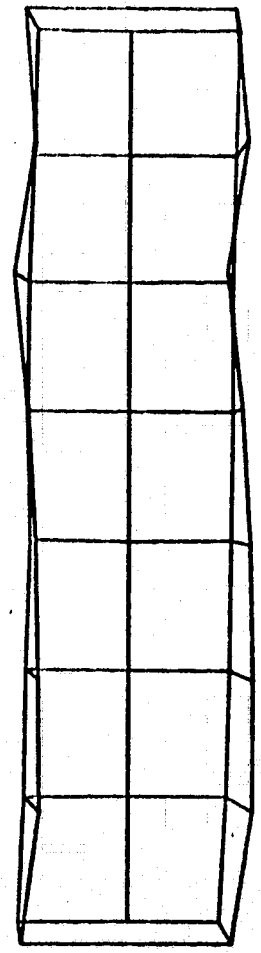
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(8) = 12.79 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-2.00000000E+03	Y = 0.	EYE TO EYE = 3.0 IN
Z = 1.50000000E+02	Z = 0.	
RUN NO. = ORTHO3	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(8) = 12.79 HZ

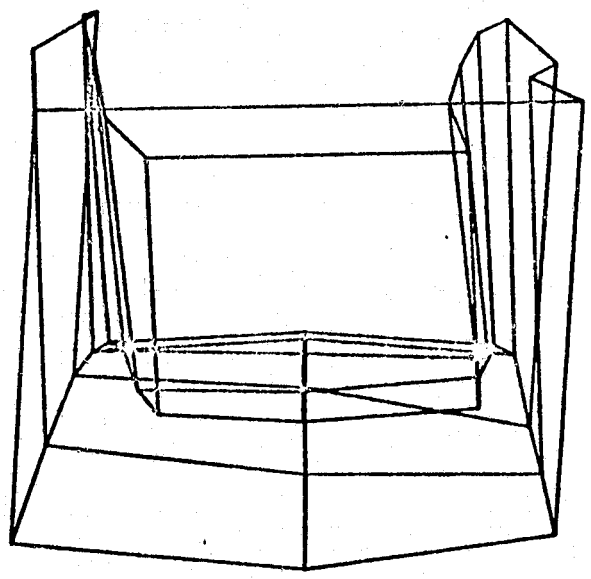
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(8) = 12.79 HZ

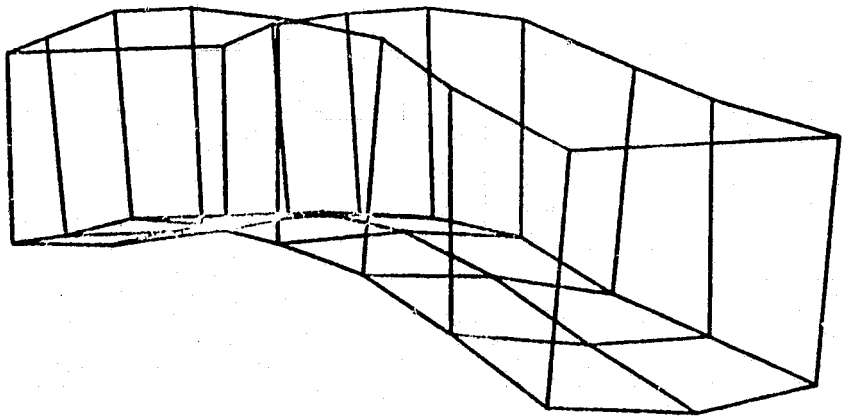
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(8) = 12.79 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

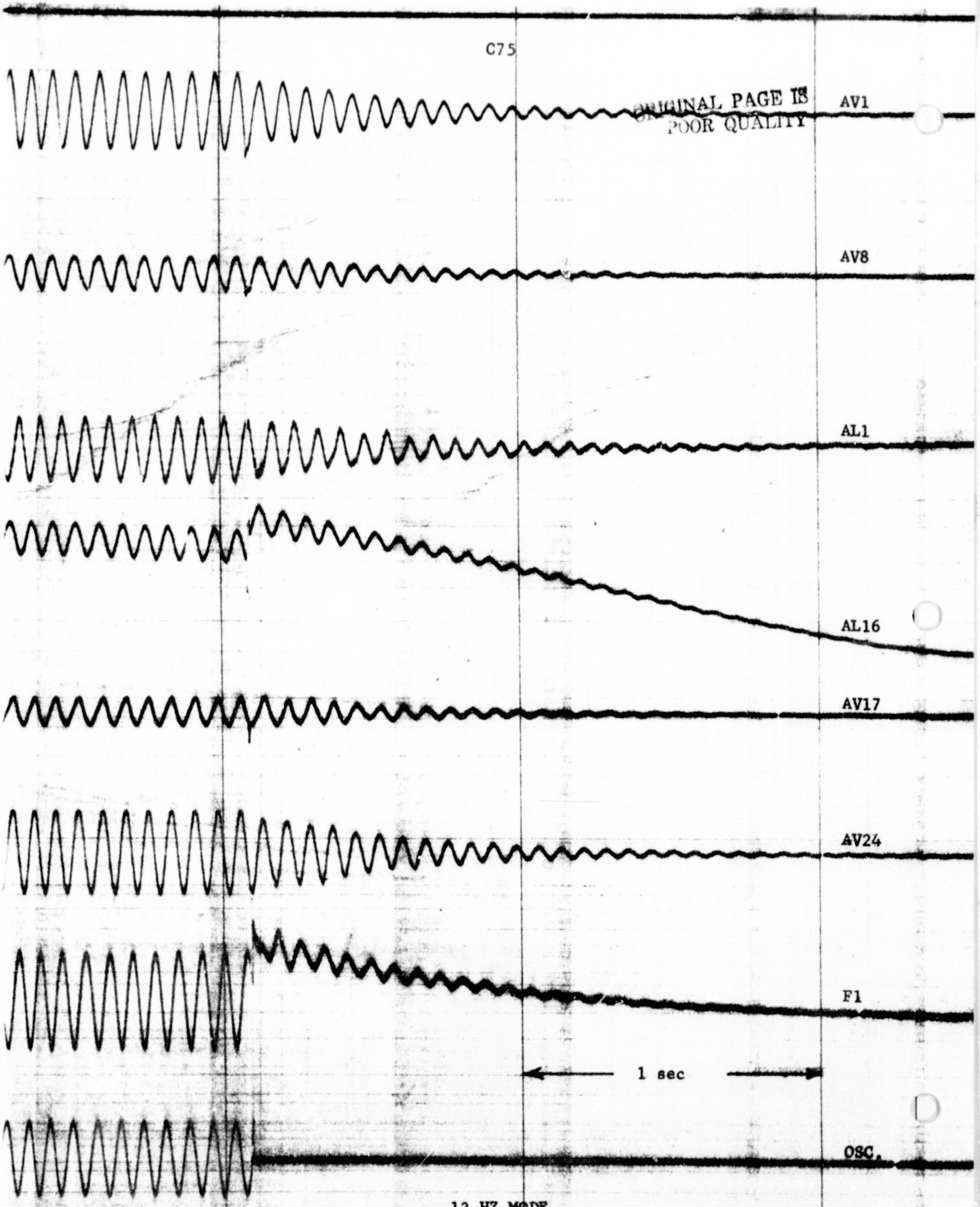
13.0 HZ
MODE

13 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
*AV1/F1	2.2E-04	3.97E-03	AL1/F1	10.3E-04	-1.42E-03
AV2	-1.1	-1.39	AL2	5.3	-0.78
AV3	-6.0	0.62	AL3	0.9	0.63
AV4	-1.8	1.48	AL4	-1.1	0.55
AV5	-3.2	1.67	AL5	2.1	-1.03
AV6	4.8	-0.11	AL6	-1.0	-0.87
AV7	3.7	-0.34	AL7	-5.1	0.42
AV8	-2.6	1.62	AL8	8.8	1.64
AV9	-4.7	3.0	AL9	13.1	-3.84
AV10	-1.5	1.2	AL10	-7.3	-0.04
AV11	2.9	-0.94	AL11	-12.4	4.6
AV12	6.0	-2.17	AL12	-7.3	1.44
AV13	5.0	-1.93	AL13	6.7	-3.24
AV14	2.8	-0.7	AL14	15.3	-4.59
AV15	-1.7	1.47	AL15	10.2	-0.53
AV16	-5.8	3.58	AL16	-7.4	3.4
AV17	1.0	1.26	AL17	5.8	-0.87
AV18	3.7	-0.36	AL18	-2.7	0.47
AV19	-2.6	0.89			
AV20	-3.9	1.6			
AV21	-5.4	1.65			
AV22	-5.1	0.36			
AV23	1.7	-1.84			
AV24	0.2	4.28			
AV25	1.6	-2.37			
AV26	4.0	-1.3			
AV27	2.3	-1.27			
AV28	-0.1	-2.58			
AV29	0.7	-2.01			
AV30	1.8	-2.02			
AV31	-0.9	-2.2			
AV32	2.8	-1.06			
F5	0.7003	0.1209			

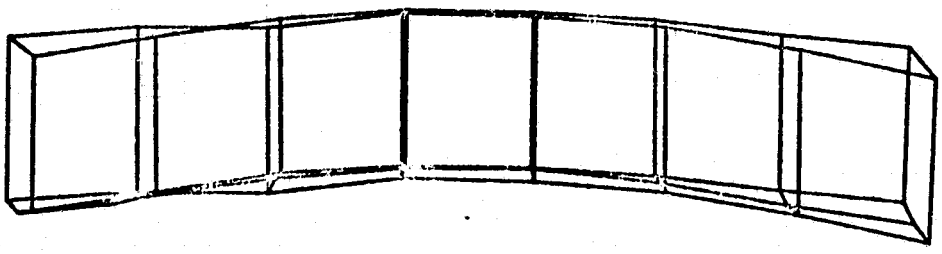
*Tuning Measurements - AV1, F1 = 154 lb-pk

ORIGINAL PAGE IS
POOR QUALITY



13 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(9) = 13.00 HZ

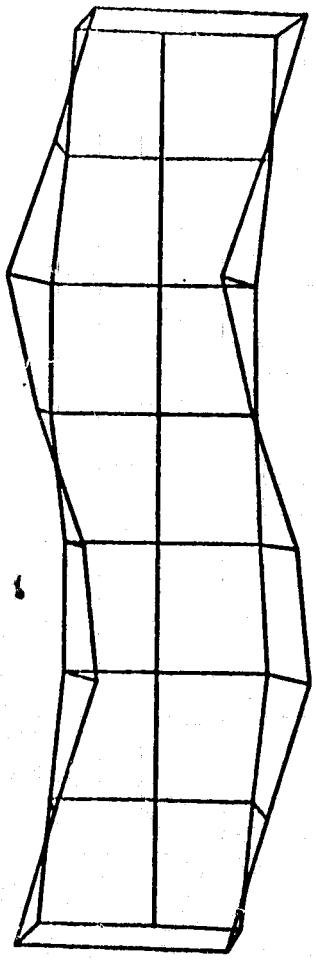
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

LEFT EYE VIEW



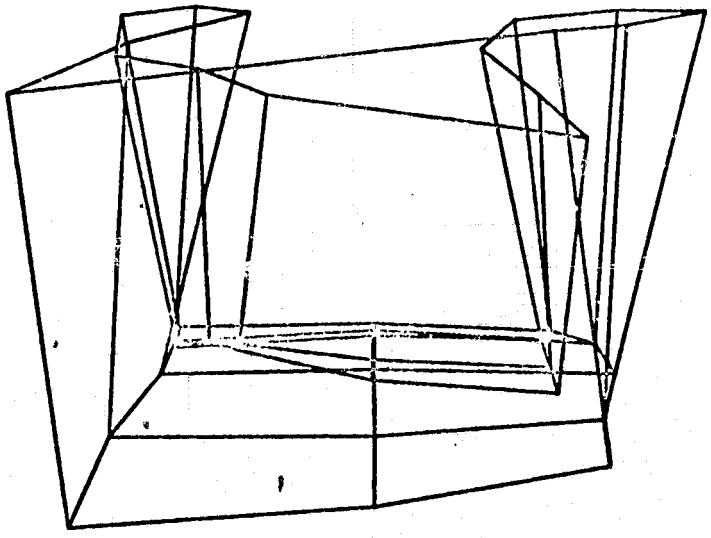
EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE( ) = 13.00 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

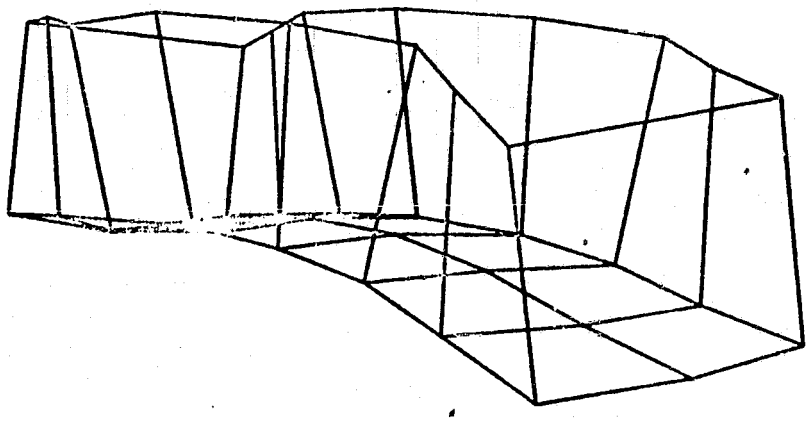


LEFT EYE VIEW

EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(9) = 13.00 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. =" ORTH03	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(9) = 13.00 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.50000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-7.00000000E+02	Y = 0.	CONE ANGLE = 20.0DEG
Z = 2.00000000E+02	Z = 0.	EYE TO EYE = 3.0 IN

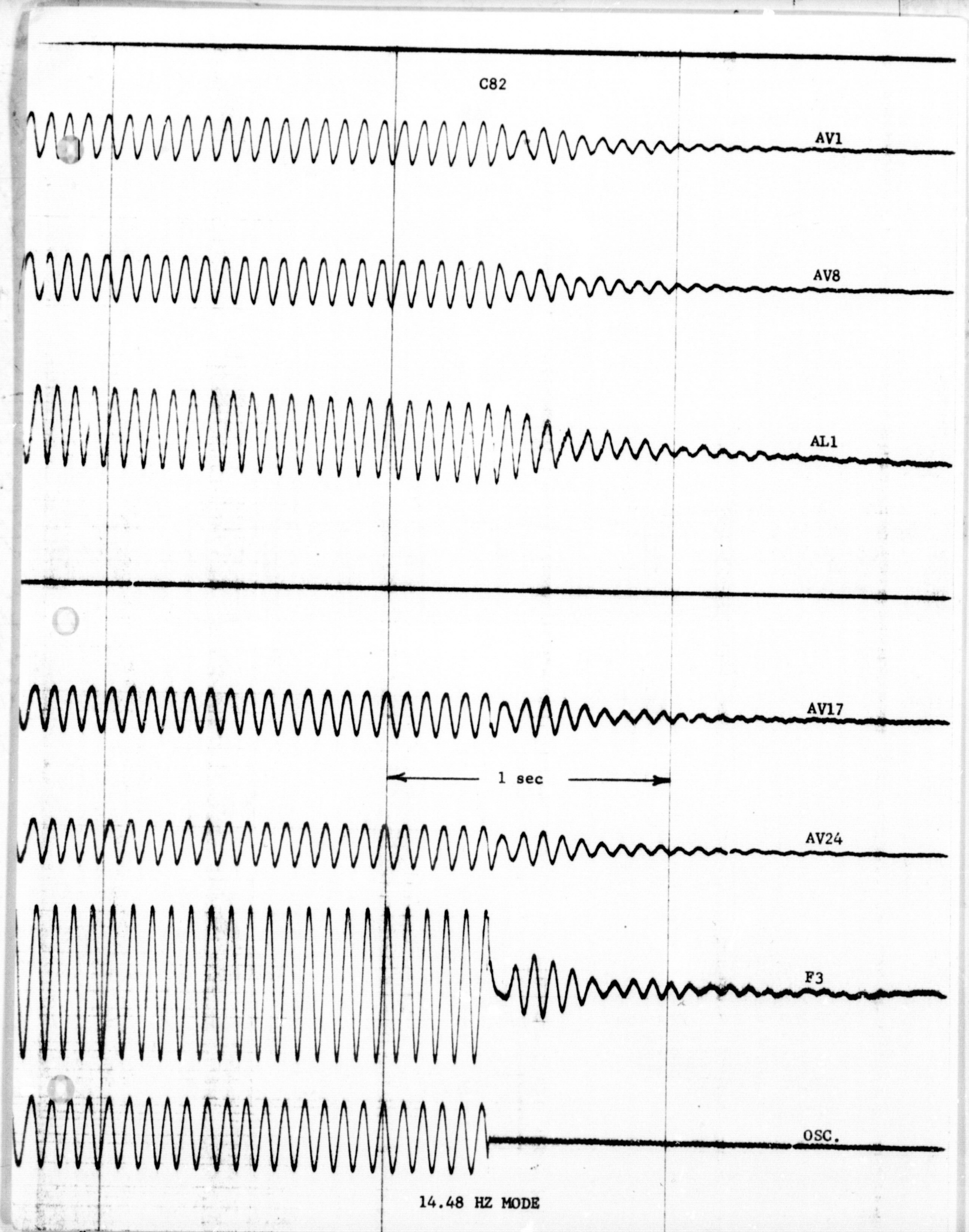
RUN NO. = ORTH03 DATE = 02JA75

14.48 HZ
MODE

14.48 HZ MODE

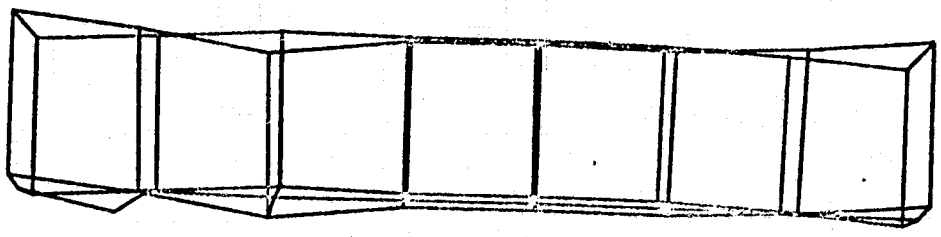
MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	0.4E-04	-3.57E-03	AL1/F3	0.9E-04	2.85E-03
AV2	3.0	1.32	AL2	-0.7	2.09
AV3	6.5	0.2	AL3	-6.2	0.21
AV4	6.9	0.16	AL4	-8.3	0.71
AV5	4.7	0.0	AL5	-9.9	0.82
AV6	12.6	-3.08	AL6	-6.6	0.32
AV7	5.2	0.75	AL7	1.7	2.28
AV8	-2.6	-3.31	AL8	3.1	3.47
AV9	-1.4	0.28	AL9	-1.8	6.97
AV10	-0.8	0.0	AL10	12.6	-4.84
AV11	2.7	-0.23	AL11	0.5	-7.66
AV12	2.5	0.0	AL12	-1.2	5.0
AV13	2.0	0.26	AL13	-5.7	3.77
AV14	2.5	0.3	AL14	-2.1	-8.7
AV15	-0.7	0.21	AL15	14.9	-3.05
AV16	-1.3	0.32	AL16	11.2	6.9
*AV17	4.3	3.1	AL17	1.3	0.62
AV18	-2.2	-1.17	AL18	0.2	-1.94
AV19	-4.1	0.24			
AV20	-5.5	0.06			
AV21	-9.3	-0.07			
AV22	-7.6	0.36			
AV23	-3.8	-1.26			
AV24	2.4	3.1			
AV25	3.6	1.31			
AV26	4.6	0.95			
AV27	-1.8	-1.29			
AV28	-3.5	-1.18			
AV29	1.0	0.11			
AV30	2.0	0.31			
AV31	5.9	1.43			
AV32	-2.6	-1.2			
F1/F3	-0.9764	-2.091E-02			
F5	1.026	3.934E-02			
F7	0.985	-7.904E-02			

*Tuning Measurements - AV17, F3 = 112 lb-pk



14.48 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(10) = 14.48 HZ

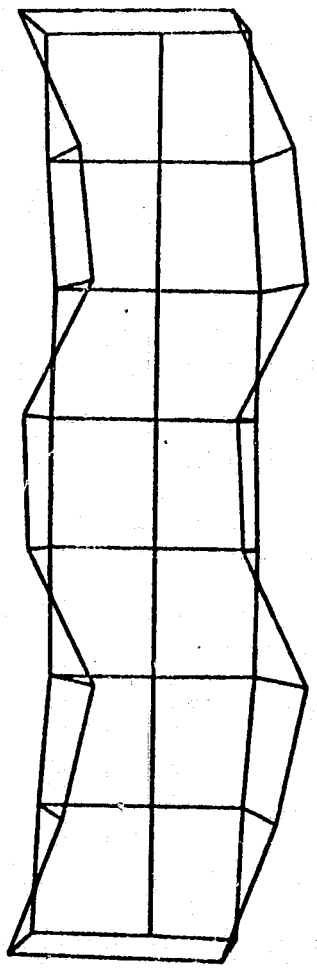
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = -2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(10) = 14.48 HZ

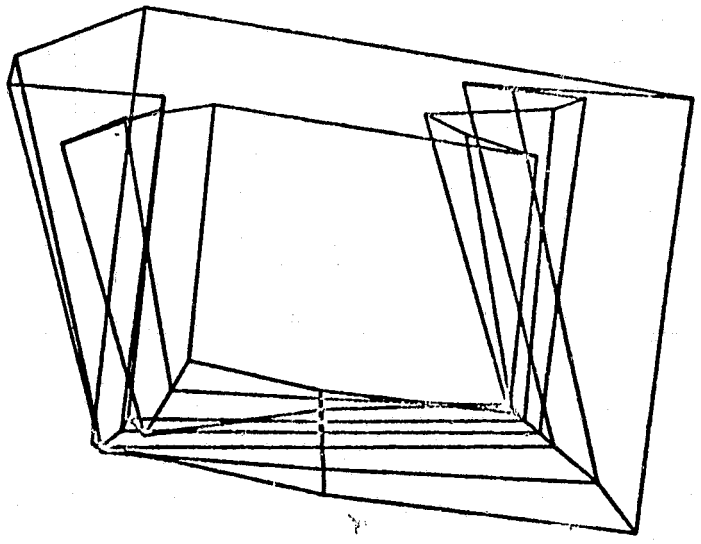
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

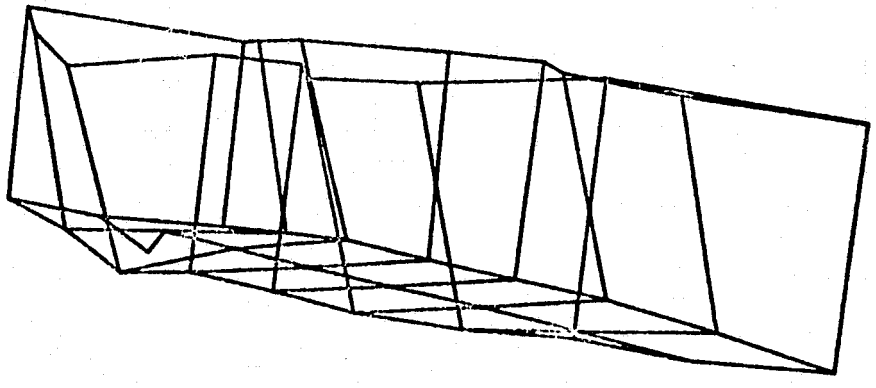
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(10) = 14.48 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.20000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 7.00000000E+01	Z = 0.	
RUN NO. = ORTH03	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(10) = 14.48 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

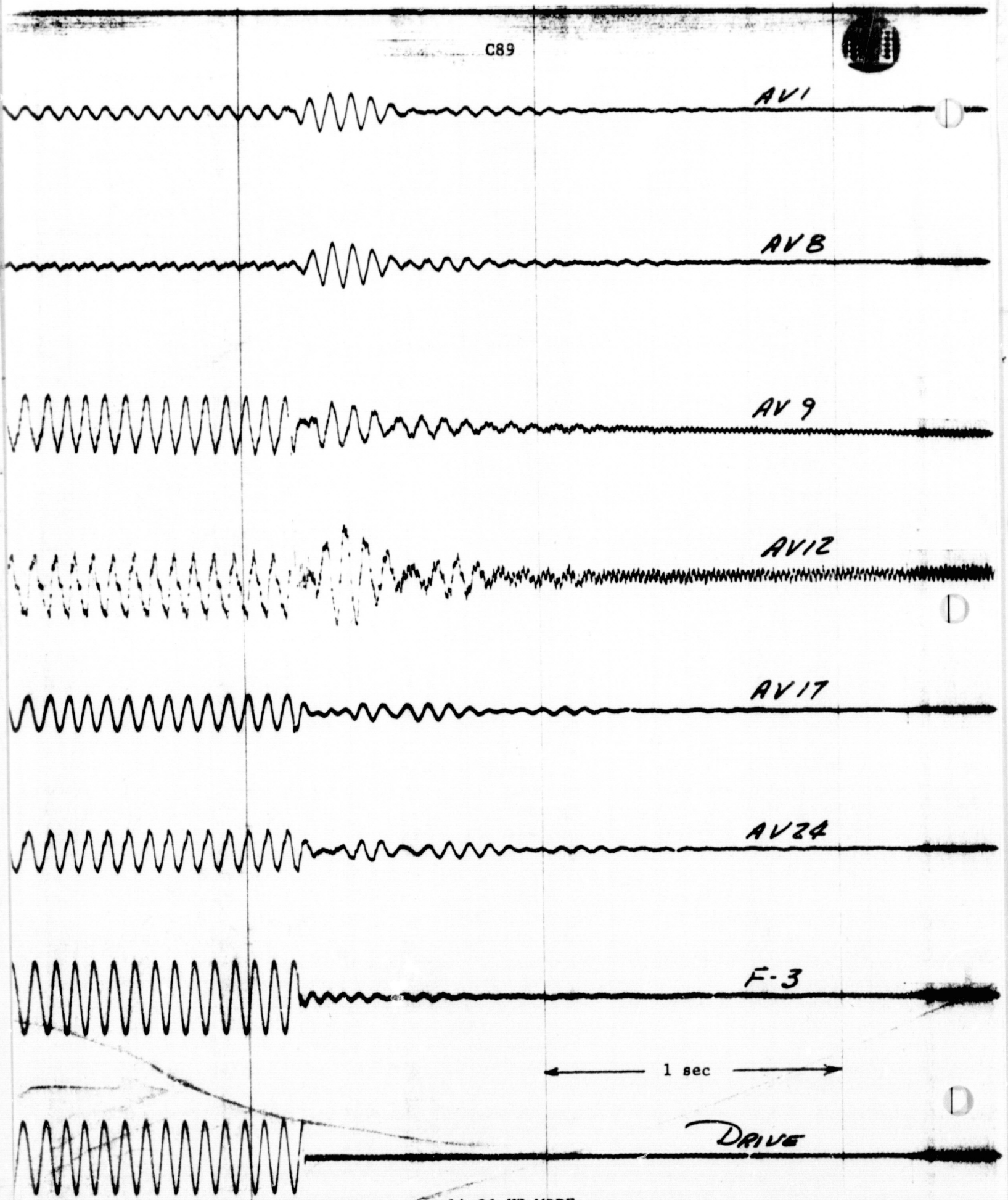
RUN NO. = ORTH03
DATE = 02JA75

14.96 HZ
MODE

14.96 HZ MODE

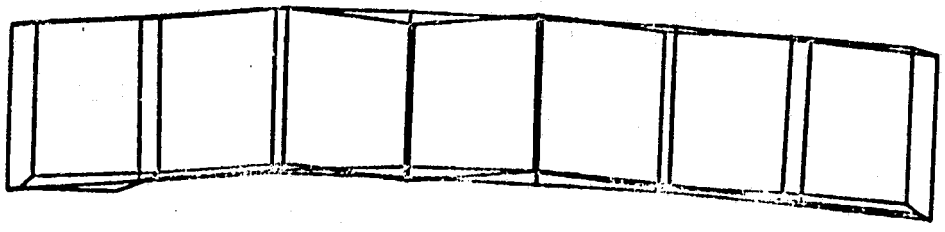
MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	5.0E-04	1.58E-03	AL1/F3	0.6E-04	1.6E-04
AV2	-2.1	-0.55	AL2	0.5	1.7
AV3	-0.5	0.42	AL3	0.2	-0.4
AV4	2.2	0.66	AL4	0.2	-0.4
AV5	3.5	0.91	AL5	-0.9	1.4
AV6	-0.1	0.96	AL6	-2.4	-1.3
AV7	1.5	-0.55	AL7	0.7	3.6
AV8	6.4	2.0	AL8	2.1	1.8
AV9	6.5	1.83	AL9	0.3	0.2
AV10	4.3	0.82	AL10	-1.4	-32.2
AV11	1.7	-0.57	AL11	1.9	-11.0
*AV12	-0.4	-1.42	AL12	8.2	44.7
AV13	-1.1	-1.47	AL13	0.5	48.7
AV14	0.1	-0.59	AL14	-33.5	-12.9
AV15	3.1	1.01	AL15	-34.1	-35.3
AV16	11.0	2.49	AL16	-0.7	-1.2
AV17	7.3	1.41	AL17	-2.4	-2.2
AV18	2.1	-0.62	AL18	-0.3	-6.2
AV19	-9.7	-0.64			
AV20	-0.5	0.75			
AV21	7.5	-0.88			
AV22	-0.7	0.55			
AV23	1.5	-1.05			
AV24	7.5	2.0			
AV25	-4.4	-1.12			
AV26	-5.0	-1.10			
AV27	-6.0	-1.07			
AV28	-4.9	-1.2			
AV29	-4.7	-1.08			
AV30	-4.3	-1.17			
AV31	-2.6	-0.9			
AV32	-4.5	-0.92			
F1/F3	0.6363	1.36E-03			
F4	-0.9504	-0.2917			
F5	0.6306	0.1513			
F7	0.5017	0.1231			

*Tuning Measurements - AV12, F3 = 283 lb-pk



14.96 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(11) = 14.96 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = -2.00000000E+03
Z = 1.50000000E+02

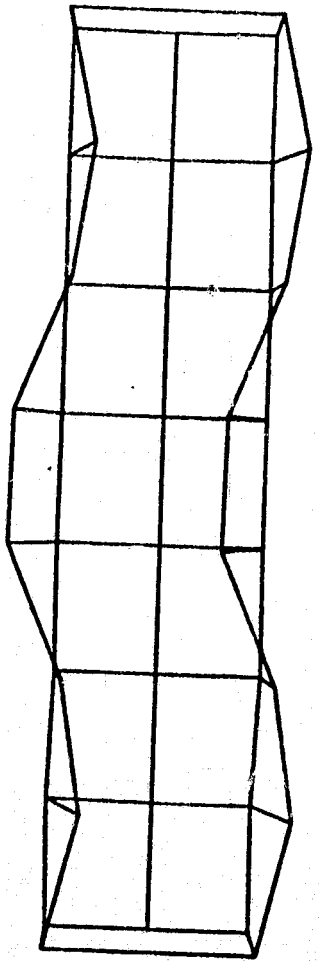
VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

C-4

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(11) = 14.96 HZ

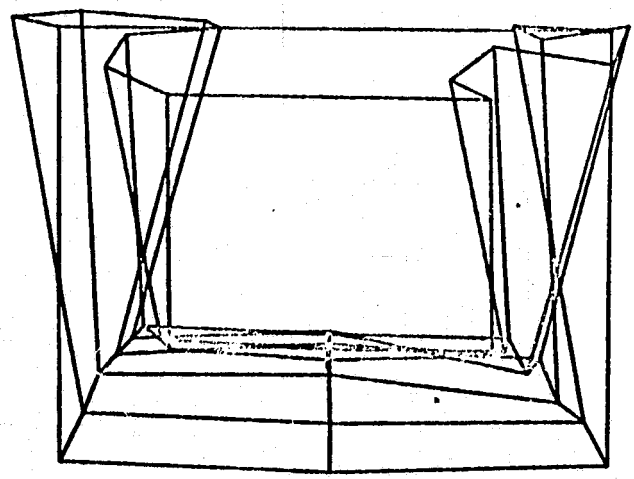
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(11) = 14.96 HZ

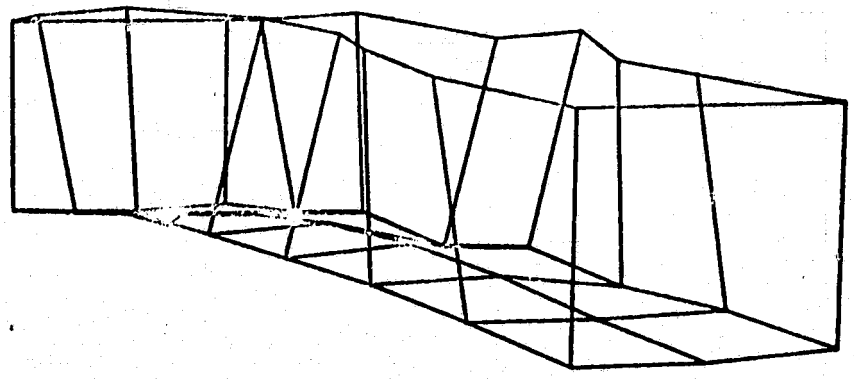
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .1, MODE(11) = 14.96 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

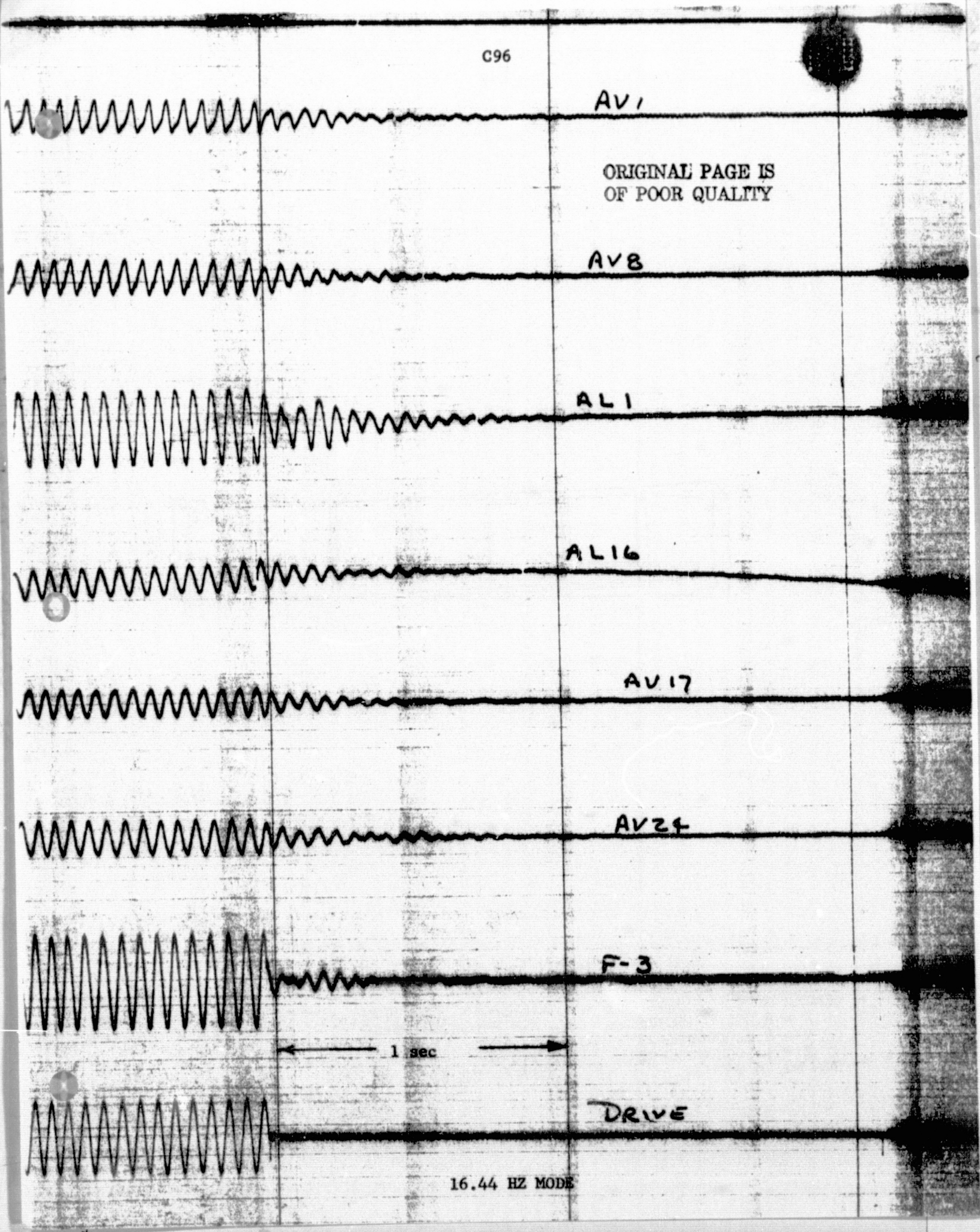
RUN NO. = ORTH03
DATE = 02JA75

16.44 HZ
MODE

16.44 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	8.3E-04	-1.42E-03	AL1/F3	-11.3E-04	1.76E-03
AV2	10.3	0.52	AL2	-7.9	1.05
AV3	6.0	0.32	AL3	-10.7	0.92
AV4	2.0	0.0	AL4	-5.0	0.62
AV5	-2.5	-0.46	AL5	5.9	-0.92
AV6	-1.4	-0.68	AL6	11.1	-1.12
AV7	10.0	-0.48	AL7	6.4	-0.6
AV8	8.4	1.5	AL8	9.8	-1.59
AV9	3.1	0.0	AL9	-0.2	3.37
AV10	0.9	-0.03	AL10	16.9	-4.24
AV11	1.4	-0.06	AL11	-16.2	-0.57
AV12	1.5	0.27	AL12	-14.9	2.44
AV13	0.0	0.14	AL13	12.4	-2.97
AV14	-1.0	-0.16	AL14	-2.4	3.06
AV15	-1.8	-0.35	AL15	-30.9	5.3
AV16	-4.1	-0.2	AL16	-5.8	-3.21
*AV17	9.1	1.09	AL17	-1.6	0.68
AV18	-9.0	-0.85	AL18	5.5	-0.69
AV19	-4.2	-0.65			
AV20	3.1	-0.48			
AV21	1.5	0.21			
AV22	6.5	0.34			
AV23	11.1	0.57			
AV24	-11.2	-1.5			
AV25	4.2	0.72			
AV26	-4.4	-0.48			
AV27	-5.9	-0.46			
AV28	9.3	0.51			
AV29	-0.2	0.19			
AV30	1.9	0.37			
AV31	6.3	0.70			
AV32	-7.2	-0.52			
F1/F3	-0.9338	3.32 E-03			
F5	-0.931	-0.1096			
F7	0.7118	1.308E-02			

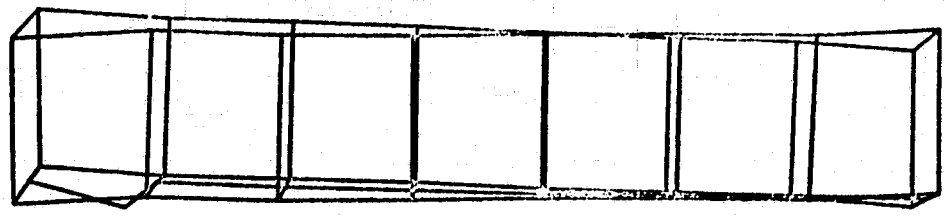
*Tuning Measurements - AV17, F3 = 147 lb-pk



ORIGINAL PAGE IS
OF POOR QUALITY

16.44 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(12) = 16.44 HZ

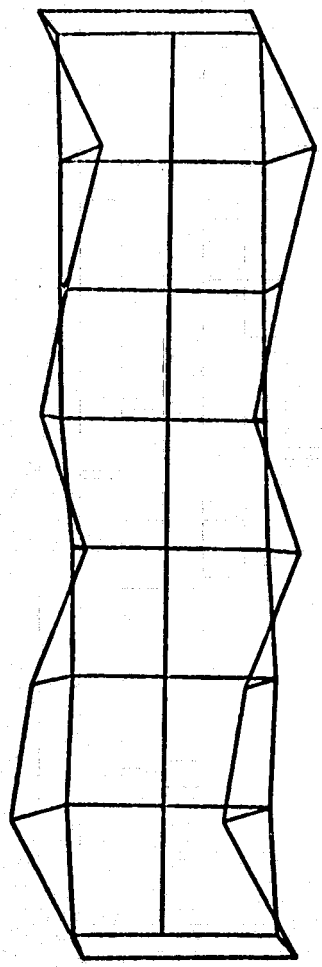
CENTER OF E[illegible]LOCATION
X = 2.030[illegible]0E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(12) = 16.44 HZ

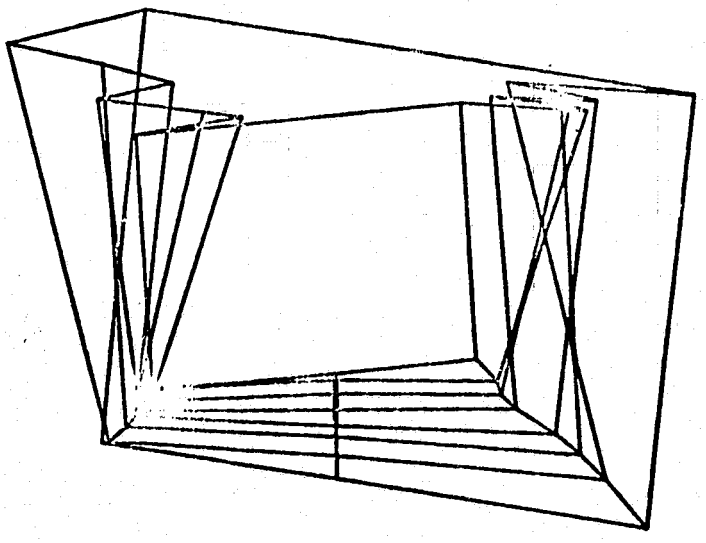
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(12) = 16.44 HZ

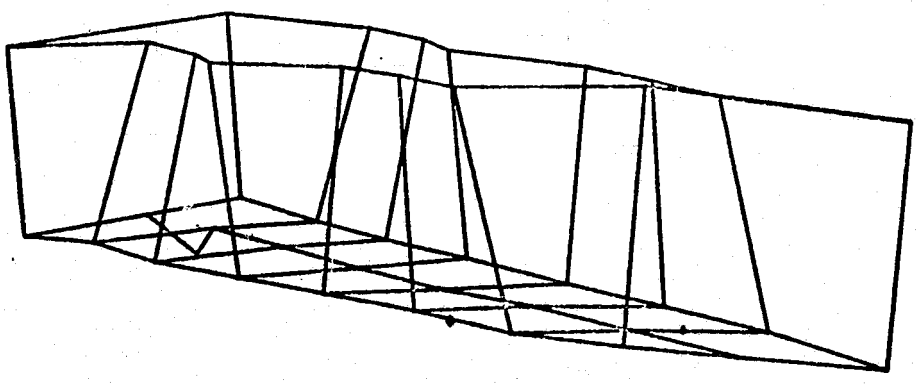
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(12) = 16.44 HZ

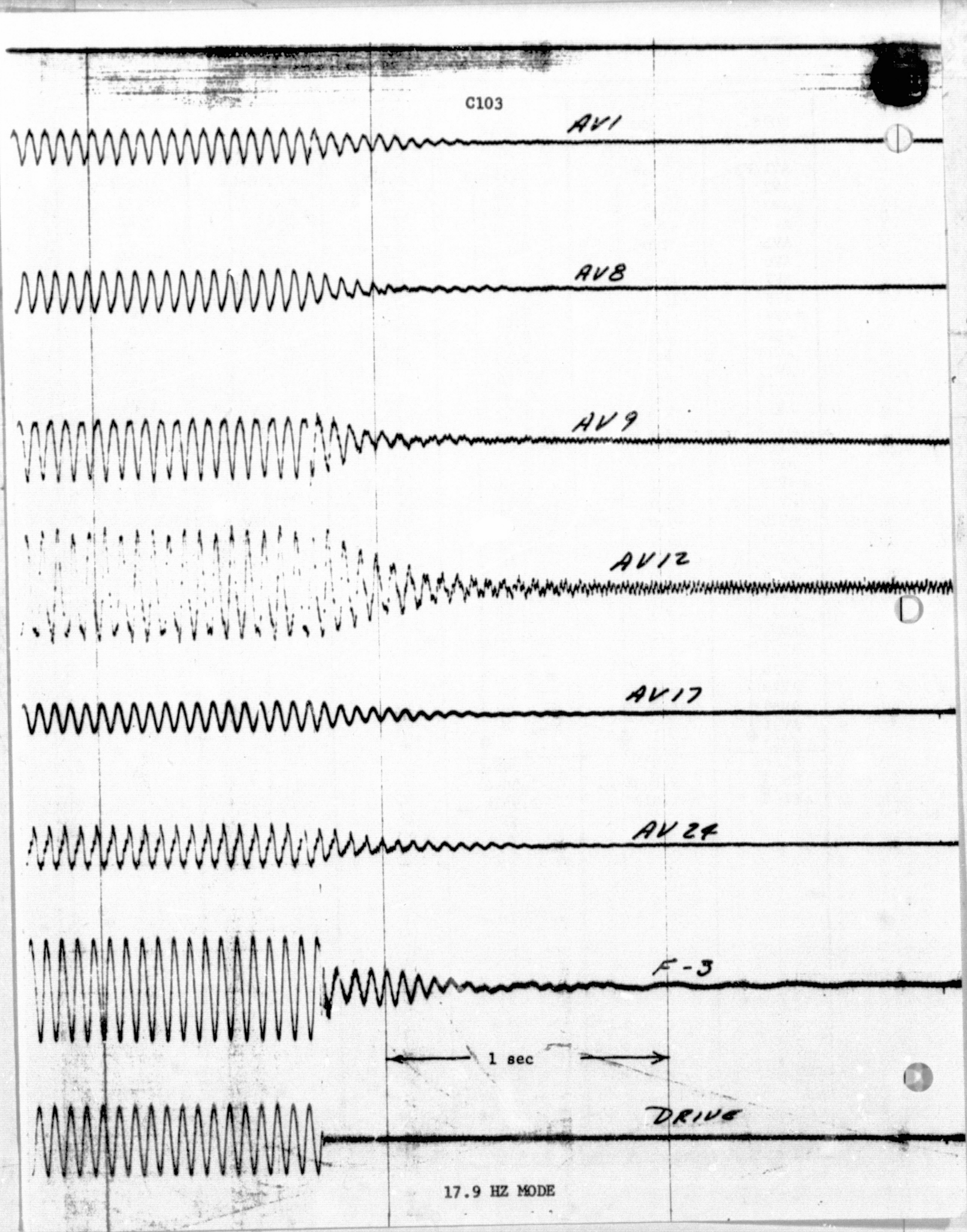
CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 1.50000000E+03	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y =-7.00000000E+02	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+02	Z = 0.	
RUN NO. = ORTHO3	DATE = 02JA75	

17.9 HZ
MODE

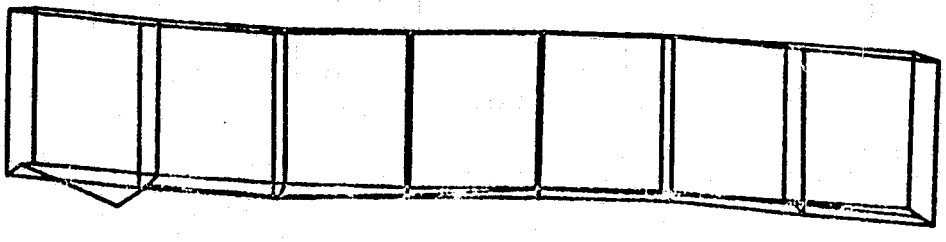
17.9 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	7.4E-04	3.1E-03	AL1/F3	2.4E-04	0.09E-03
AV2	-0.7	-1.34	AL2	-2.7	-0.13
AV3	-3.7	1.19	AL3	-0.5	-0.22
AV4	-3.8	1.16	AL4	0.0	0.52
AV5	1.0	0.4	AL5	1.7	-0.46
AV6	9.4	-0.74	AL6	1.0	0.64
AV7	12.0	0.92	AL7	0.0	0.25
AV8	-15.2	-3.46	AL8	0.3	0.01
*AV9	11.1	2.87	AL9	-1.6	0.5
AV10	4.0	0.23	AL10	-12.8	9.74
AV11	4.1	-2.15	AL11	-20.1	11.66
AV12	7.1	-1.84	AL12	-19.7	2.76
AV13	4.2	0.96	AL13	-6.9	-4.34
AV14	-2.4	2.52	AL14	-23.0	-6.39
AV15	-11.0	0.14	AL15	-46.3	-4.05
AV16	-18.2	-4.59	AL16	1.4	0.29
AV17	6.7	2.3	AL17	-3.5	-1.6
AV18	-0.3	-1.18	AL18	-1.3	-1.85
AV19	-3.7	-0.32			
AV20	-3.0	0.26			
AV21	0.1	-0.43			
AV22	7.1	-0.60			
AV23	10.9	0.89			
AV24	-8.9	-3.46			
AV25	-5.7	-1.25			
AV26	15.5	1.03			
AV27	-6.5	-1.27			
AV28	13.9	0.81			
AV29	-6.2	-1.3			
AV30	-6.6	-1.29			
AV31	-5.1	-1.37			
AV32	-6.2	-1.40			
F1/F3	1.05	2.24E-02			
F5	-9.503E-01	-2.2E-01			
F7	-1.017	-2.952E-01			

*Tuning Measurements - AV9, F3 = 89 lb-pk


C103
AV1
AV8
AV9
AV12
AV17
AV24
F-3
1 sec
DRIVE
17.9 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(13) = 17.90 HZ

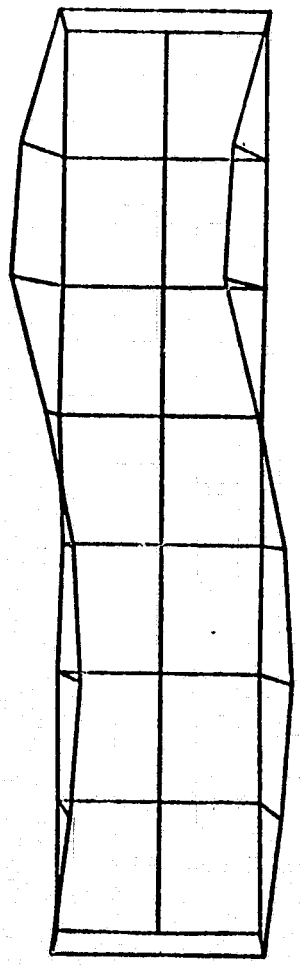
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(13) = 17.90 HZ

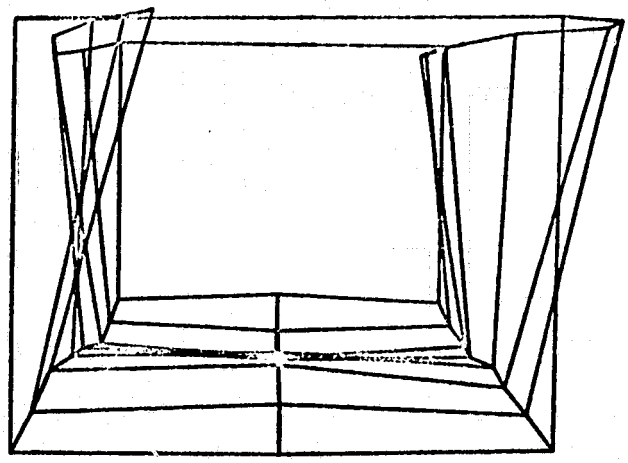
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(13) = 17.90 HZ

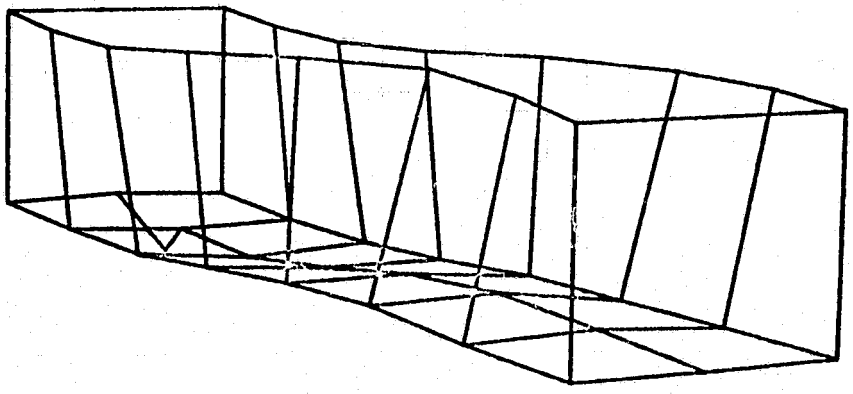
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(13) = 17.90 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VP POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

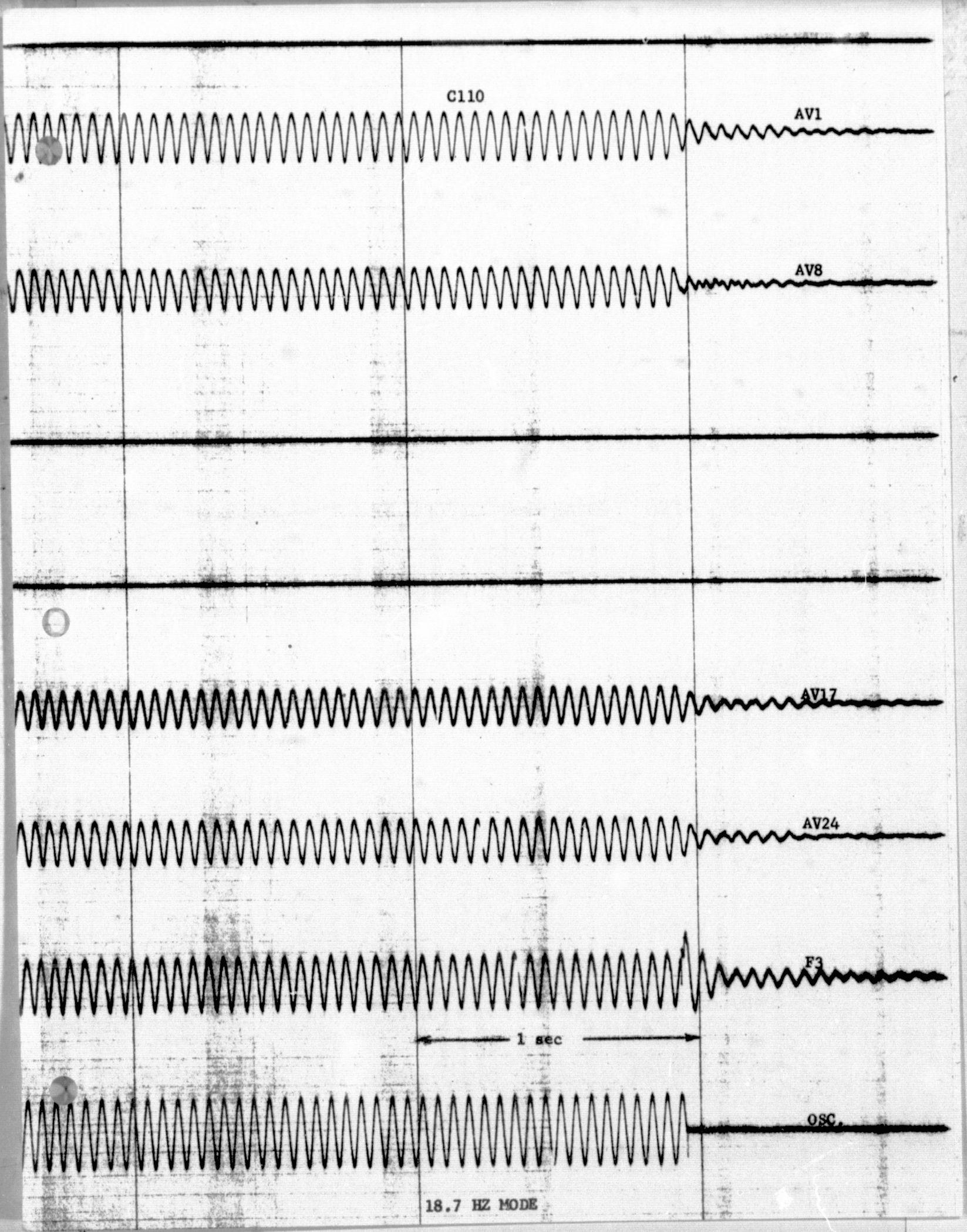
RUN NO. = ORTH03
DATE = 02JA75

18.7 HZ
MODE

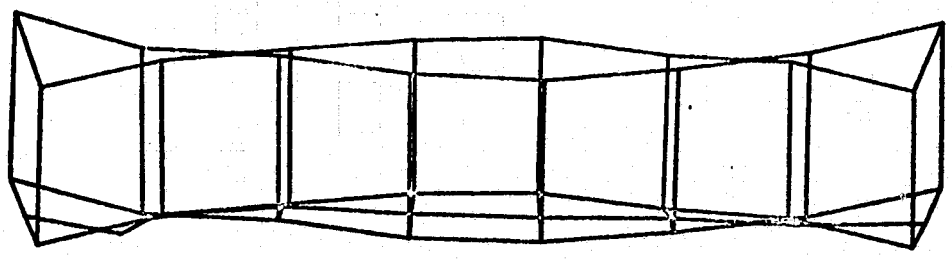
18.7 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-5.35E-03	9.72E-03	AL1/F3	1.23E-03	-0.92E-03
AV2	2.36	2.71	AL2	0.51	-0.33
AV3	1.56	-1.58	AL3	-0.31	5.89
AV4	1.43	-4.26	AL4	-0.57	6.54
AV5	0.99	-3.4	AL5	-0.37	6.88
AV6	-0.67	-0.13	AL6	0.03	5.69
AV7	-1.47	1.24	AL7	1.25	-1.95
AV8	-1.21	-8.33	AL8	1.76	-1.44
AV9	-0.84	-0.48	AL9	3.14	4.31
AV10	-0.1	0.47	AL10	0.0	0.0
AV11	0.77	-0.55	AL11	-6.27	-2.62
AV12	0.33	-0.05	AL12	1.9	-6.1
AV13	-0.42	-0.39	AL13	0.54	-1.89
AV14	-0.31	-1.63	AL14	0.99	5.82
AV15	0.32	0.77	AL15	0.86	-6.77
AV16	1.46	1.44	AL16	0.9	6.31
*AV17	3.36	6.6	AL17	1.06	-0.8
AV18	0.01	-0.37	AL18	3.94	-3.09
AV19	-1.8	0.63			
AV20	-1.85	4.03			
AV21	-1.14	3.1			
AV22	-0.35	0.5			
AV23	-0.67	-2.3			
AV24	1.72	9.31			
AV25	1.9	3.09			
AV26	-1.31	1.97			
AV27	-0.83	-1.73			
AV28	-0.87	-2.5			
AV29	0.58	1.56			
AV30	0.86	1.3			
AV31	1.88	3.47			
AV32	-0.97	-1.52			
F1/F3	-1.14	-0.6301			
F5	0.2937	0.8066			
F7	0.4893	-1.807			

*Tuning Measurements - AV17, F3 = 38 lb-pk


C110
AV1
AV8
AV17
AV24
F3
1 sec
OSC.
18.7 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(14) = 18.70 HZ

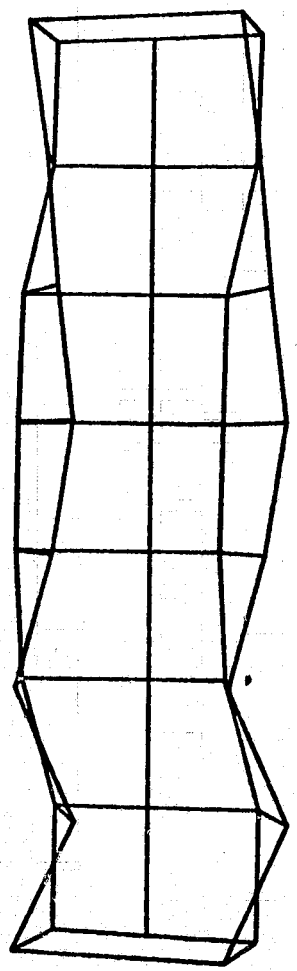
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y =-2.00000000E+03
Z = 1.50000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(14) = 18.70 HZ

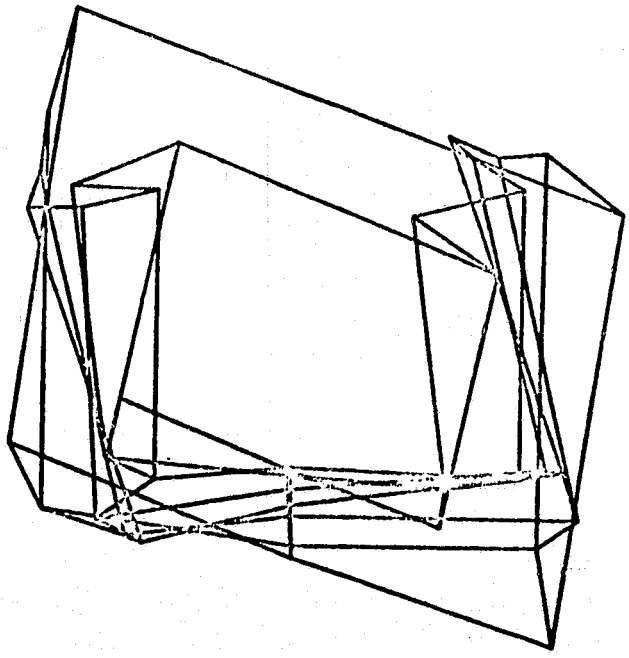
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(14) = 18.70 HZ

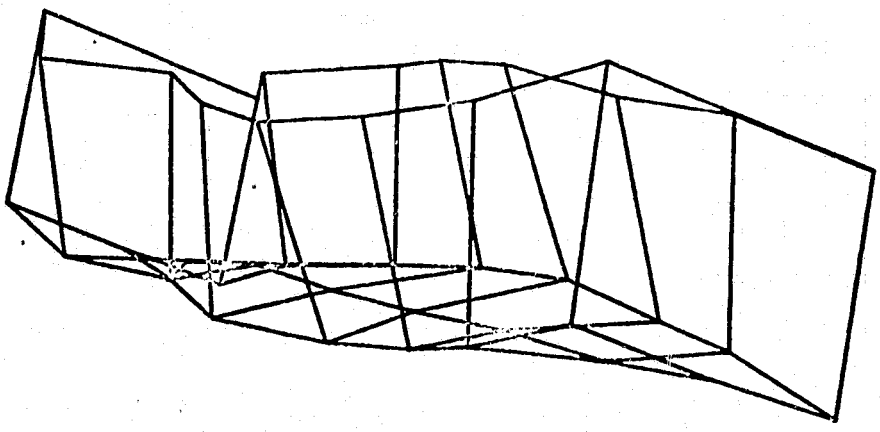
CENTER OF EYES LOCATION
X = 1.20000000E+03
Y = 0.
Z = 7.00000000E+01

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(14) = 18.70 HZ

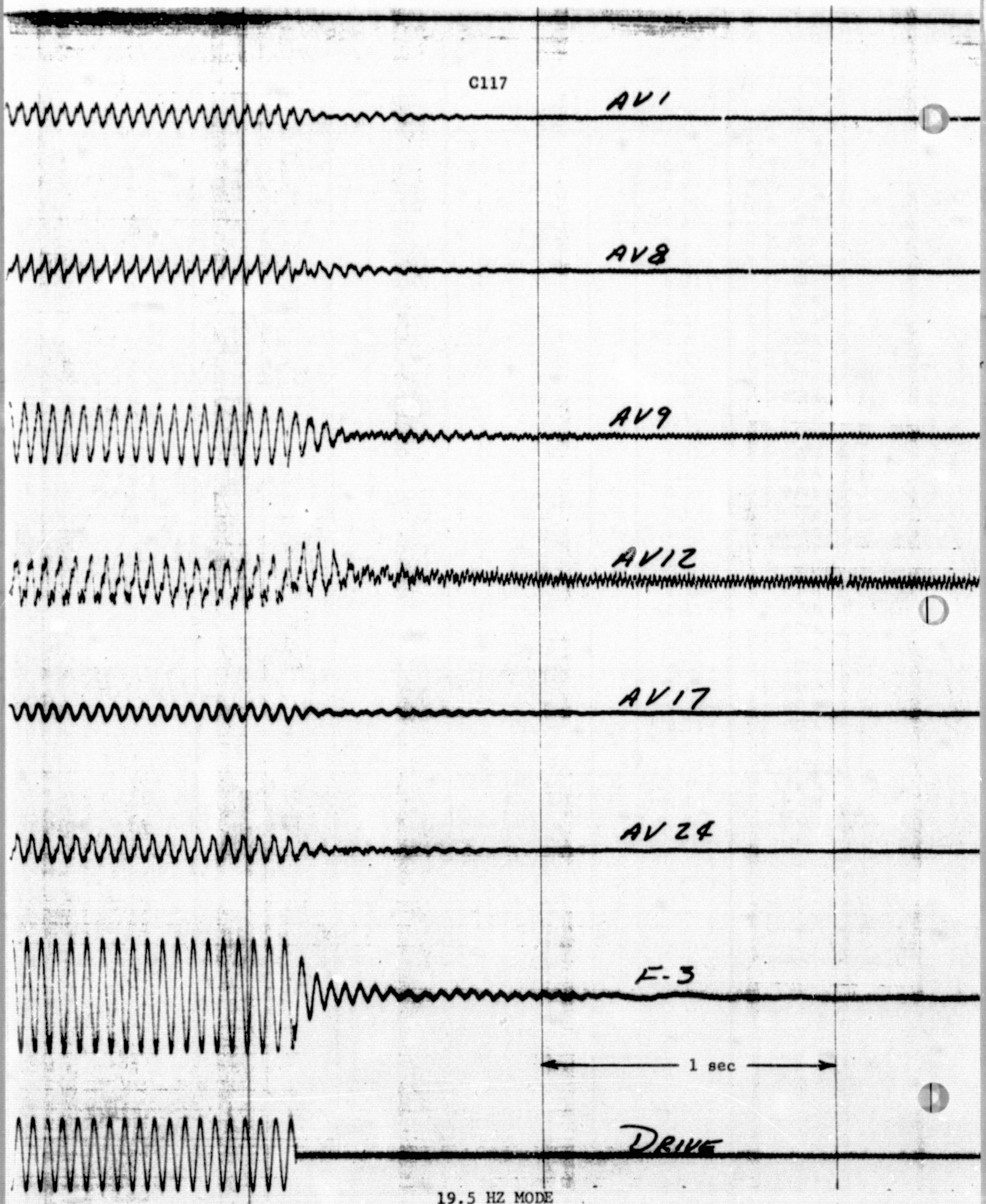
CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.50000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y =-7.00000000E+02	Y = 0.	CONE ANGLE = 20.0DEG
Z = 2.00000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH03	DATE = 02JA75	

19.5 HZ
MODE

19.5 HZ MODE

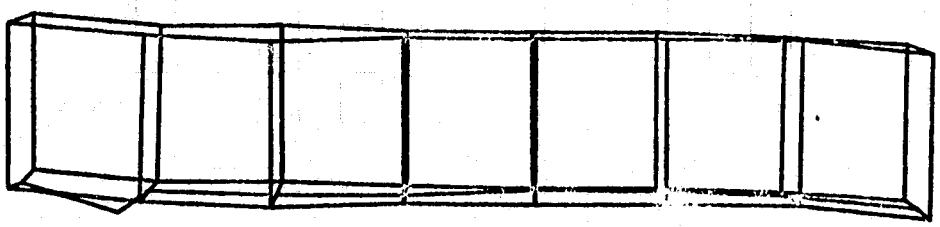
MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	0.0E-04	1.82E-03	AL1/F3	5.2E-04	-5.6E-04
AV2	-1.1	-0.16	AL2	6.3	-8.7
AV3	10.2	-0.23	AL3	2.1	-3.6
AV4	5.7	-0.45	AL4	2.9	1.2
AV5	4.6	-0.37	AL5	-2.8	-2.9
AV6	7.2	-1.16	AL6	2.9	-0.1
AV7	12.8	-0.58	AL7	-0.2	0.8
AV8	-8.8	-1.07	AL8	-4.2	-2.0
*AV9	21.0	1.48	AL9	5.0	-16.4
AV10	6.2	-0.15	AL10	-9.7	43.4
AV11	-5.2	-0.73	AL11	17.2	24.9
AV12	-3.4	-0.57	AL12	-9.8	55.0
AV13	8.3	0.21	AL13	-48.1	-11.0
AV14	9.8	0.5	AL14	-33.9	-8.7
AV15	-12.1	0.07	AL15	-13.5	59.3
AV16	-41.7	-0.85	AL16	4.0	-2.9
AV17	5.2	1.11	AL17	-14.4	-1.0
AV18	-9.0	-0.28	AL18	-11.1	7.5
AV19	-3.0	0.07			
AV20	-1.1	-0.15			
AV21	1.2	0.07			
AV22	1.0	0.56			
AV23	11.3	0.31			
AV24	-12.3	-1.79			
AV25	-9.6	-0.26			
AV26	17.8	-0.35			
AV27	-14.6	-0.06			
AV28	19.1	0.2			
AV29	-13.0	-0.21			
AV30	-11.8	-0.29			
AV31	-5.6	-0.36			
AV32	-12.5	-0.23			
F1/F3	0.7554	-4.86E-03			
F5	-0.7216	-0.2532			
F7	-0.6919	-5.242E-02			

*Tuning Measurements - AV9, F3 = 89 lb-pk



19.5 HZ MODE

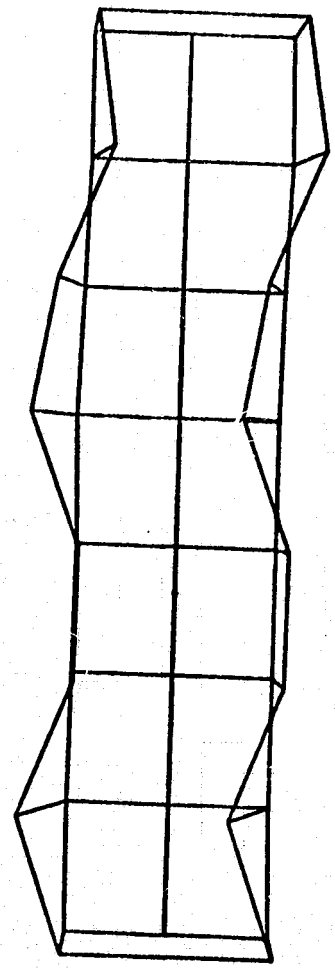
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(15) = 19.50 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 2.03000000E+02	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = -2.00000000E+03	Y = 0.	CONE ANGLE = 20.0DEG
Z = 1.50000000E+02	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH03	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(15) = 19.50 HZ

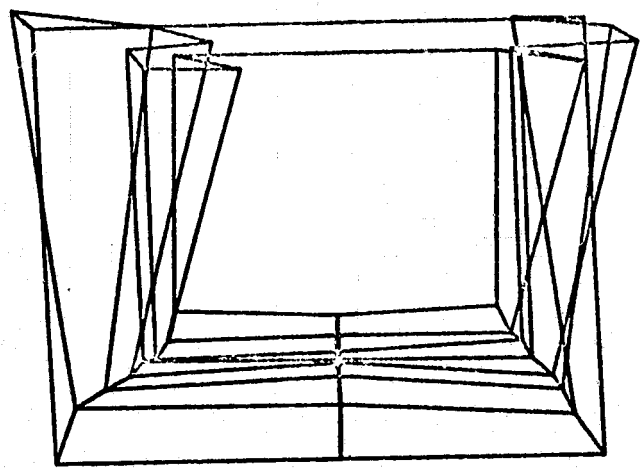
CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = 0.
Z = 2.00000000E+03

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTH03
DATE = 02JA75

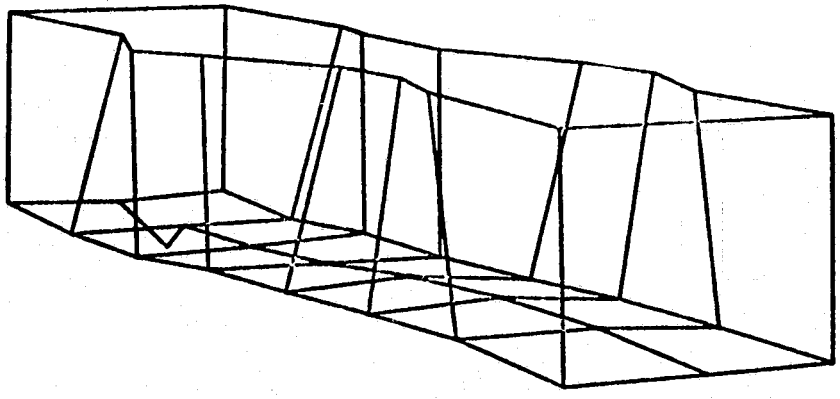
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(15) = 19.50 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTH03	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(15) = 19.50 HZ

CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

RUN NO. = ORTHO3
DATE = 02JA75

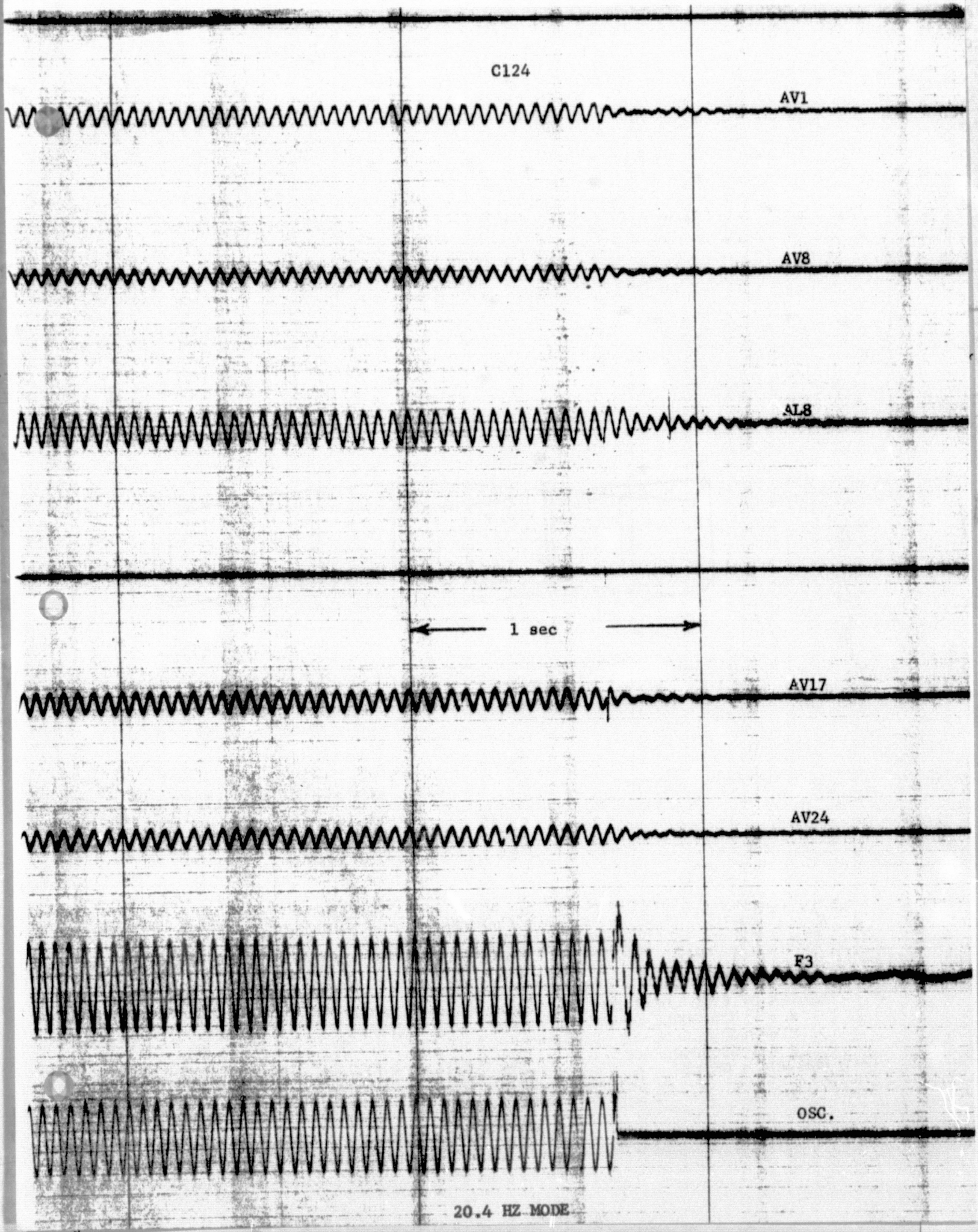
20.4 HZ
MODE

C123

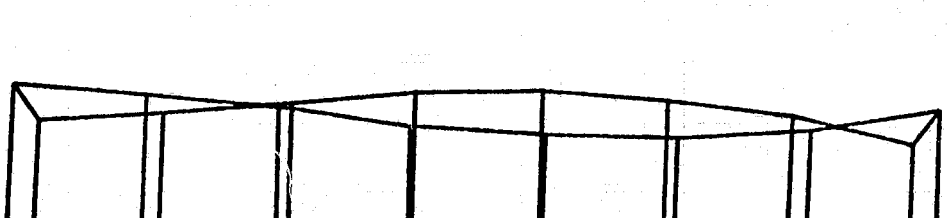
20.4 HZ MODE

MEAS. NO'S.	CO	QUAD	MEAS. NO'S.	CO	QUAD
AV1/F3	-26.7E-04	-3.38E-03	AL1/F3	5.9E-04	0.67E-03
AV2	30.0	-0.31	AL2	11.4	0.18
AV3	29.0	-2.21	AL3	6.4	1.92
AV4	14.5	-2.34	AL4	14.7	0.88
AV5	9.3	-1.78	AL5	11.8	1.13
AV6	-2.3	0.45	AL6	21.9	-0.89
AV7	-11.7	1.67	AL7	18.6	-3.12
AV8	-8.6	-2.66	AL8	18.5	-2.95
AV9	6.8	-0.59	AL9	36.6	1.84
AV10	0.8	-0.01	AL10	-113.0	-2.81
AV11	4.3	-0.75	AL11	-15.8	-0.89
AV12	7.1	-0.35	AL12	18.0	-6.88
AV13	6.2	-0.33	AL13	-25.5	-1.19
AV14	5.8	-0.57	AL14	19.7	0.61
AV15	-1.7	0.57	AL15	20.8	1.58
AV16	-3.7	1.49	AL16	23.0	1.22
*AV17	35.9	2.87	AL17	-0.5	0.28
AV18	-19.8	1.22	AL18	0.7	-1.89
AV19	-21.9	2.77			
AV20	-25.0	3.87			
AV21	-16.2	2.82			
AV22	-10.7	0.36			
AV23	0.0	-1.81			
AV24	12.3	3.61			
AV25	18.1	1.36			
AV26	-2.4	0.06			
AV27	-17.0	-2.44			
AV28	7.7	0.2			
AV29	6.8	0.47			
AV30	9.3	0.48			
AV31	25.6	0.48			
AV32	-17.1	0.48			
F1/F3	-1.442	0.7432			
F5	-0.1457	1.019			
F7	3.406E-02	-0.7398			

*Tuning Measurements - AV17, F3 = 32 lb-pk


C124
AV1
AV8
AL8
1 sec
AV17
AV24
F3
OSC.
20.4 HZ MODE

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(16) = 20.40 HZ

CENTER OF EYES LOCATION
X = 2.03000000E+02
Y = -2.00000000E+03
Z = 1.50000000E+02

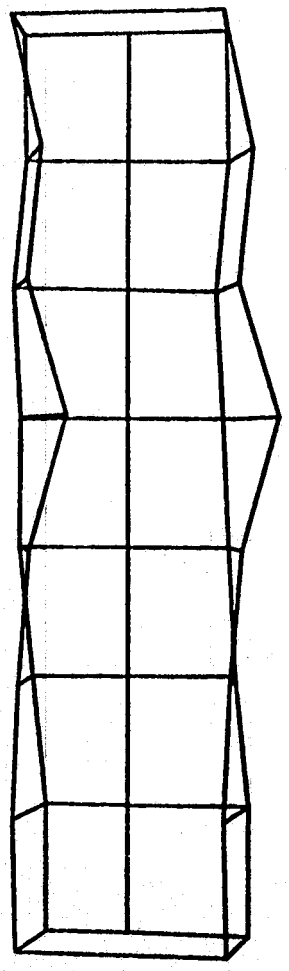
RUN NO. = ORTHO3

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

DATE = 02JA75

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

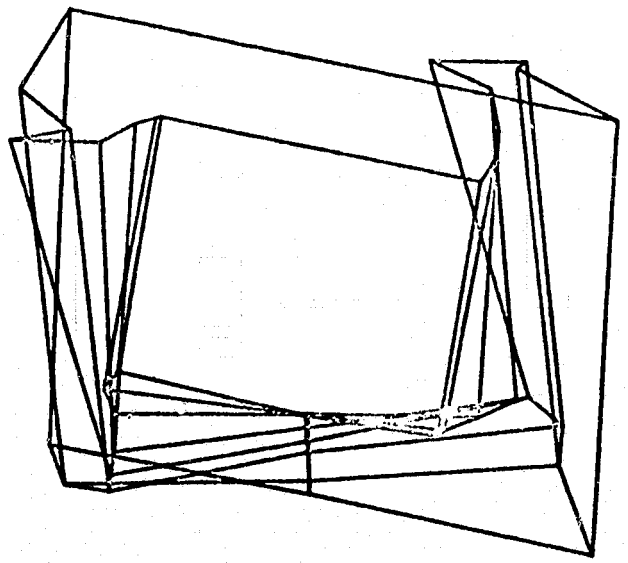
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(16) = 20.40 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	ROLL ANGLE = 180.0DEG
X = 2.03000000E+02	X = 2.03000000E+02	CONE ANGLE = 20.0DEG
Y = 0.	Y = 0.	EYE TO EYE = 3.0 IN
Z = 2.00000000E+03	Z = 0.	
RUN NO. = ORTHO3	DATE = 02JA75	

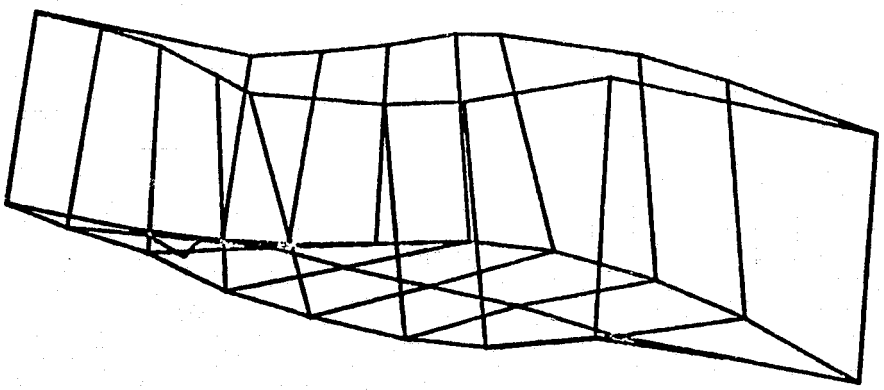
LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(16) = 20.40 HZ

CENTER OF EYES LOCATION	VIEW POINT LOCATION	
X = 1.20000000E+03	X = 2.03000000E+02	ROLL ANGLE = 180.0DEG
Y = 0.	Y = 0.	CONE ANGLE = 20.0DEG
Z = 7.00000000E+01	Z = 0.	EYE TO EYE = 3.0 IN
RUN NO. = ORTHO3	DATE = 02JA75	

LEFT EYE VIEW



EXPT.MODE SHAPES,FULL TEST CAR ON TRUCKS MF = .0, MODE(16) = 20.40 HZ

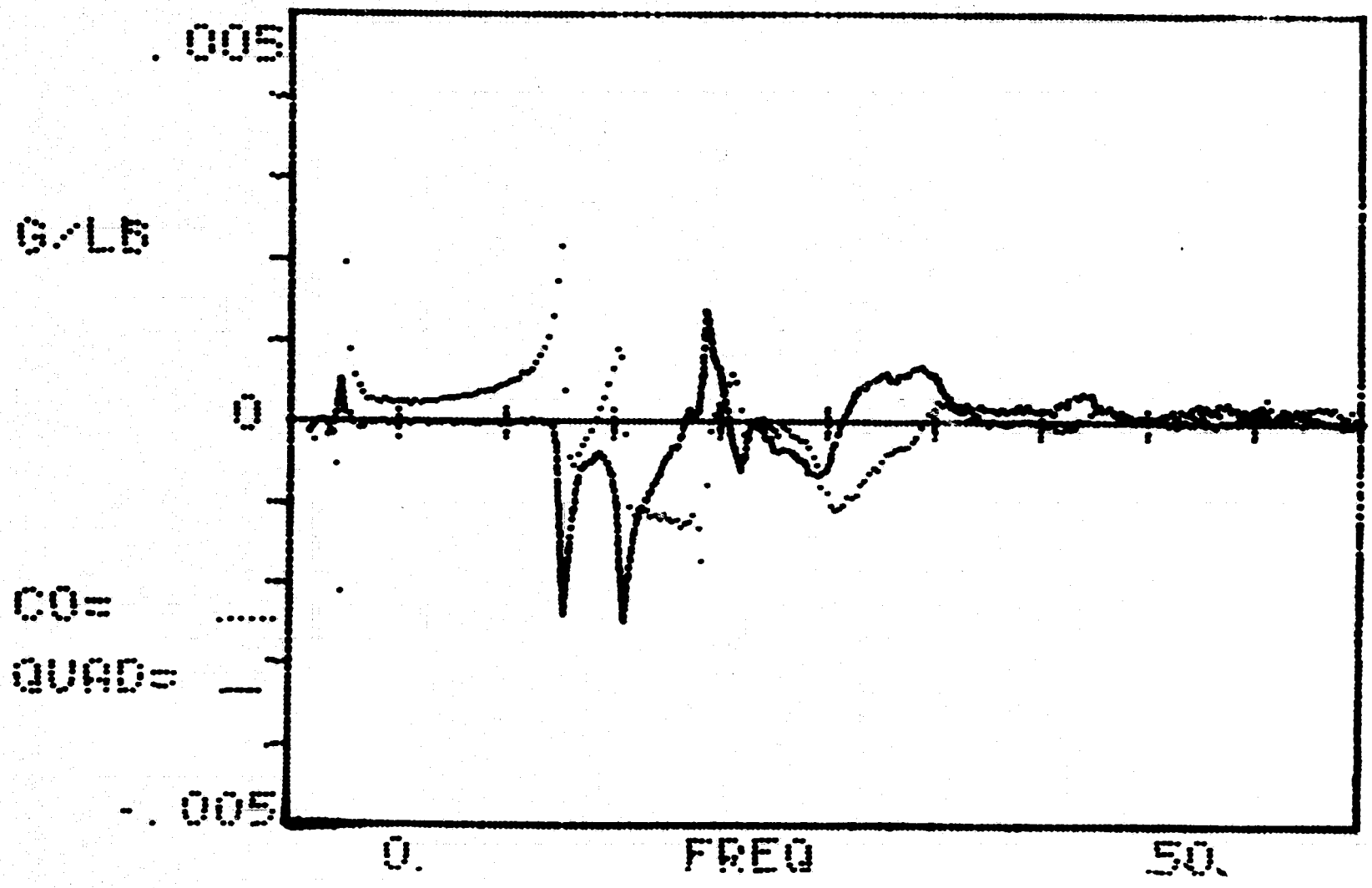
CENTER OF EYES LOCATION
X = 1.50000000E+03
Y =-7.00000000E+02
Z = 2.00000000E+02

VIEW POINT LOCATION
X = 2.03000000E+02
Y = 0.
Z = 0.

ROLL ANGLE = 180.0DEG
CONE ANGLE = 20.0DEG
EYE TO EYE = 3.0 IN

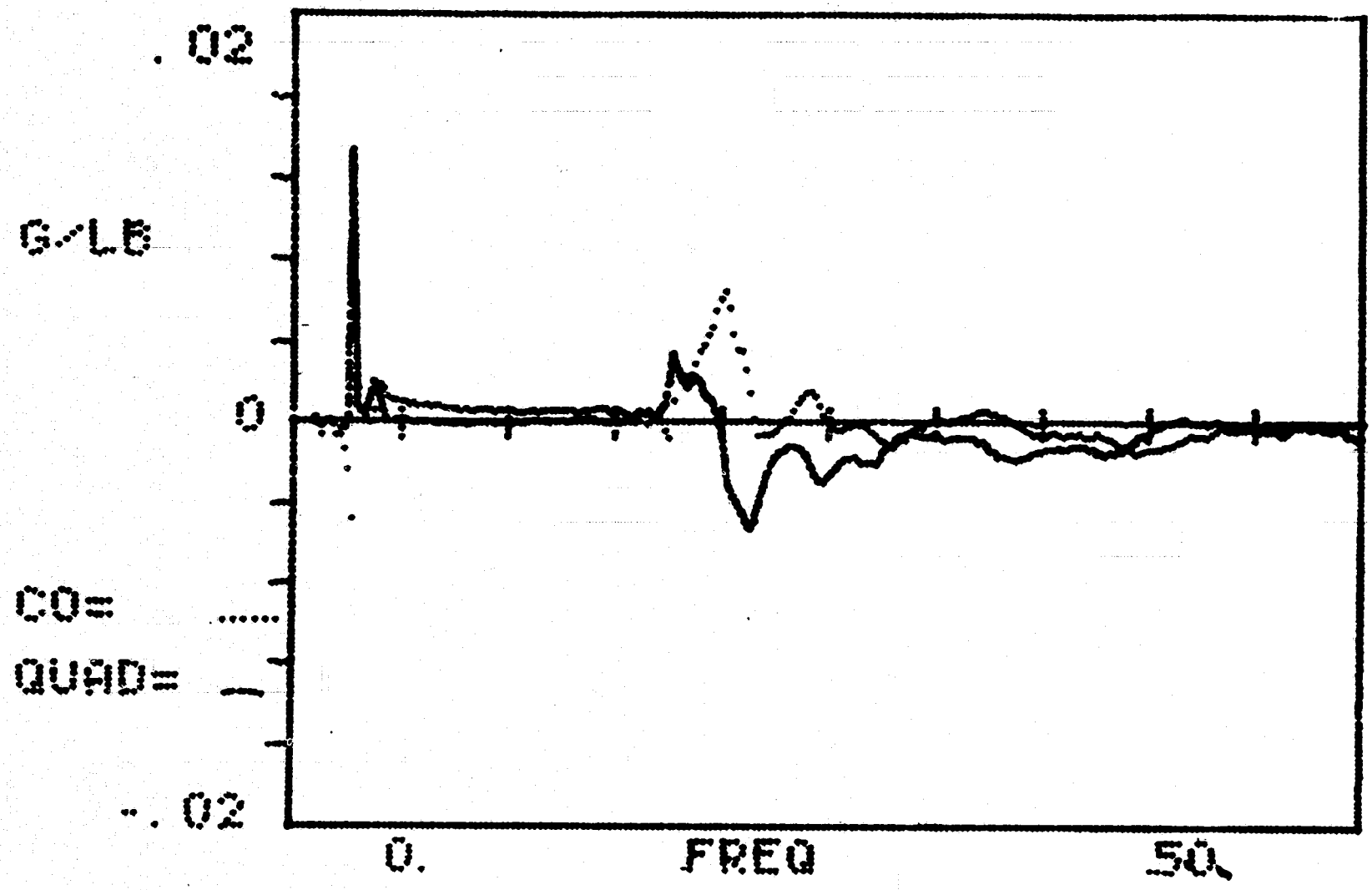
RUN NO. = ORTH03
DATE = 02JA75

BLOCKED ROLL STOP EVALUATION



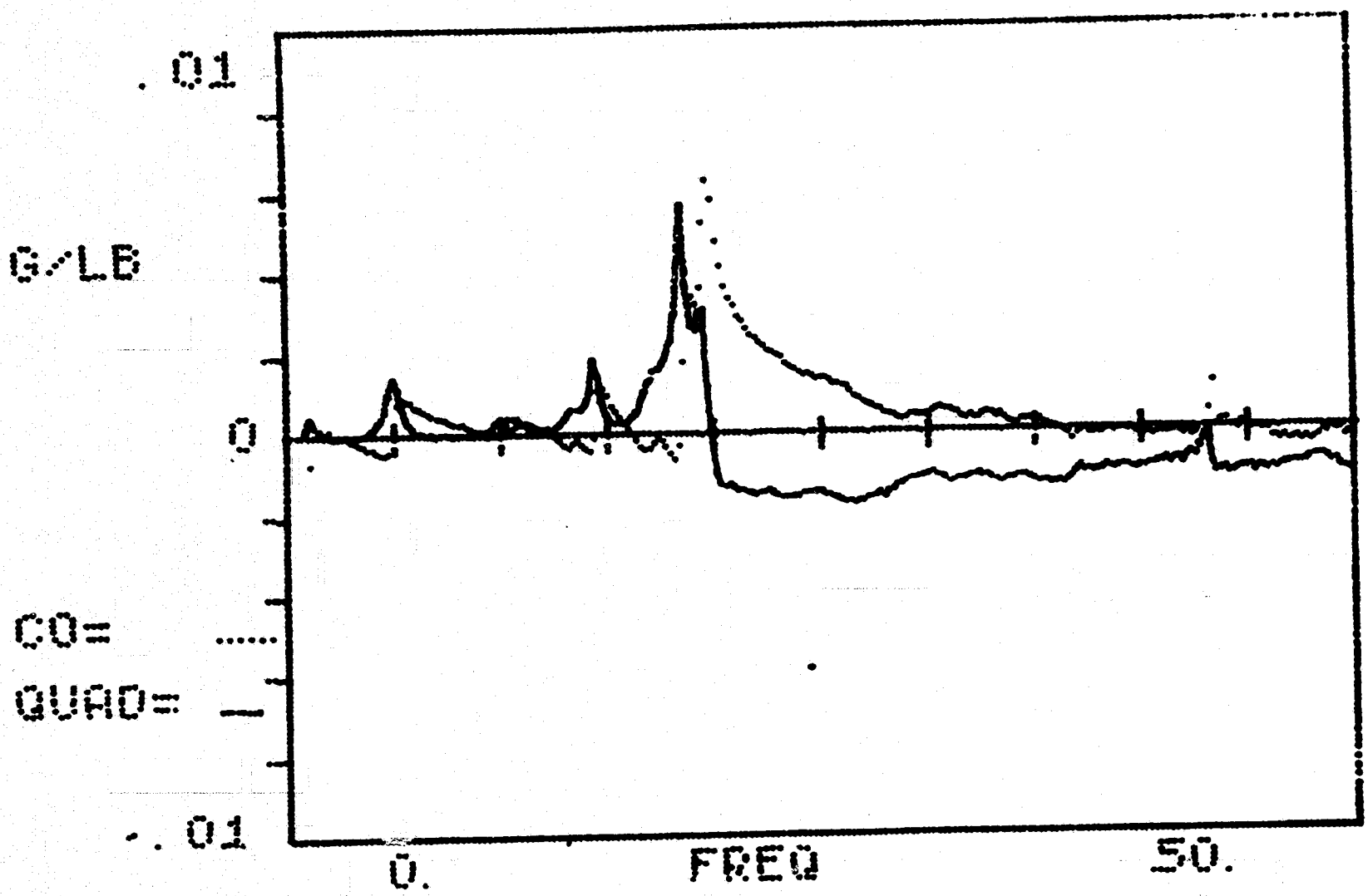
TPK TRN 12-2-74 RUN 44 WB
AV12/F3

C130

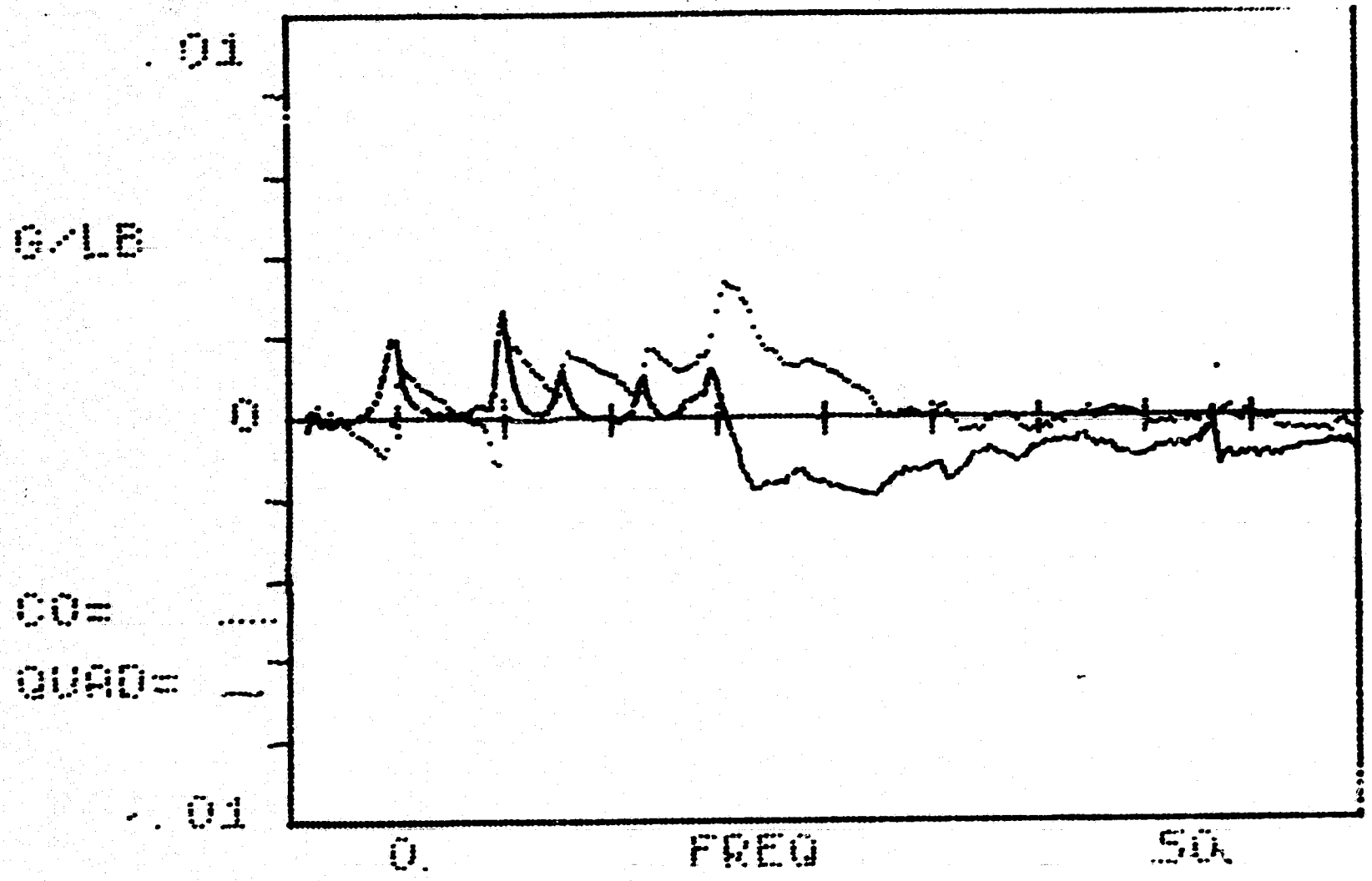


TRK TRN 12-2-74 RUN 45 WB
AUG/F3

C131



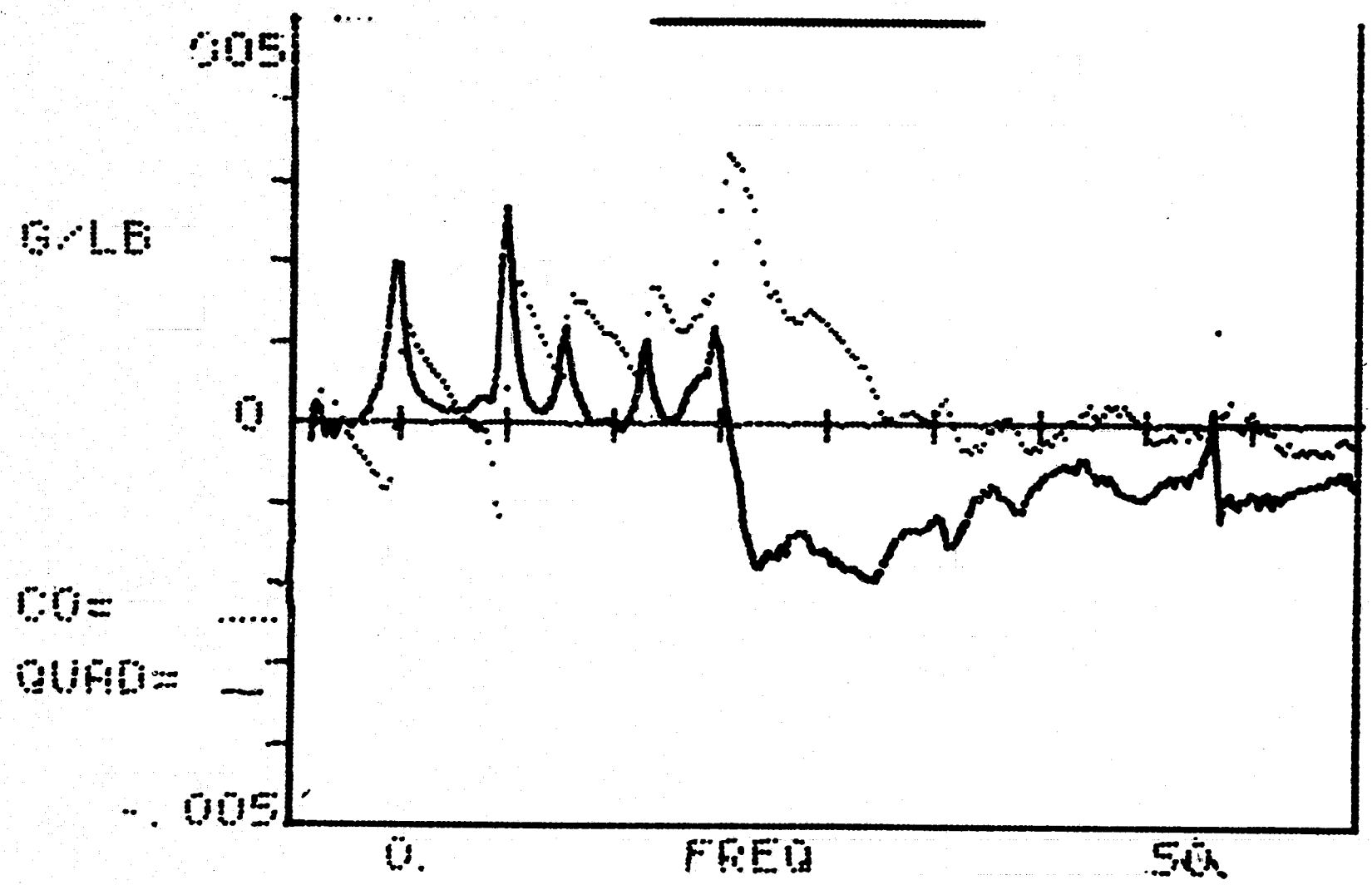
TRK TRM 12-2-74 RUN 46 WB
AV17-F3



C133

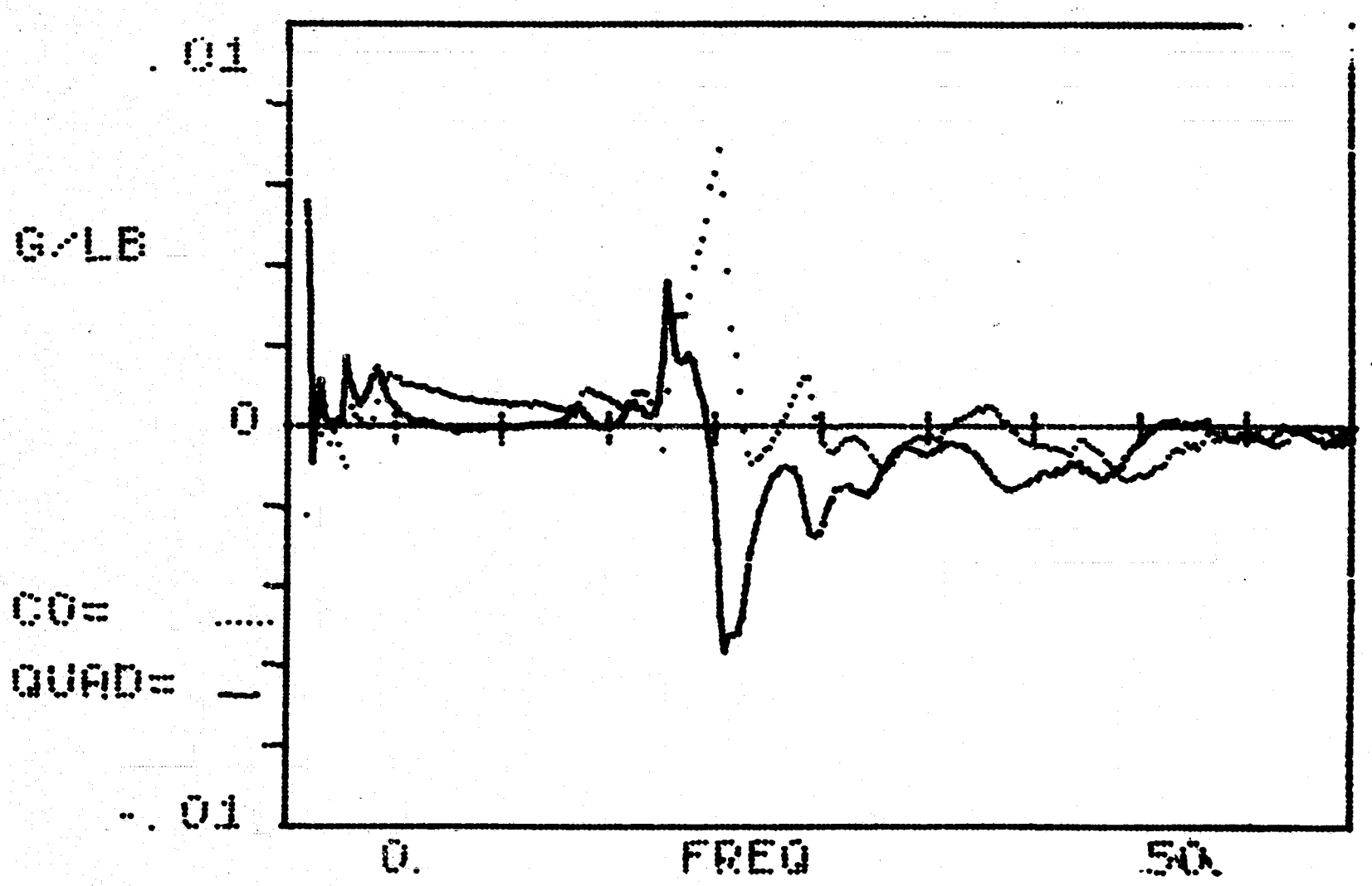
INC= .2 HZ

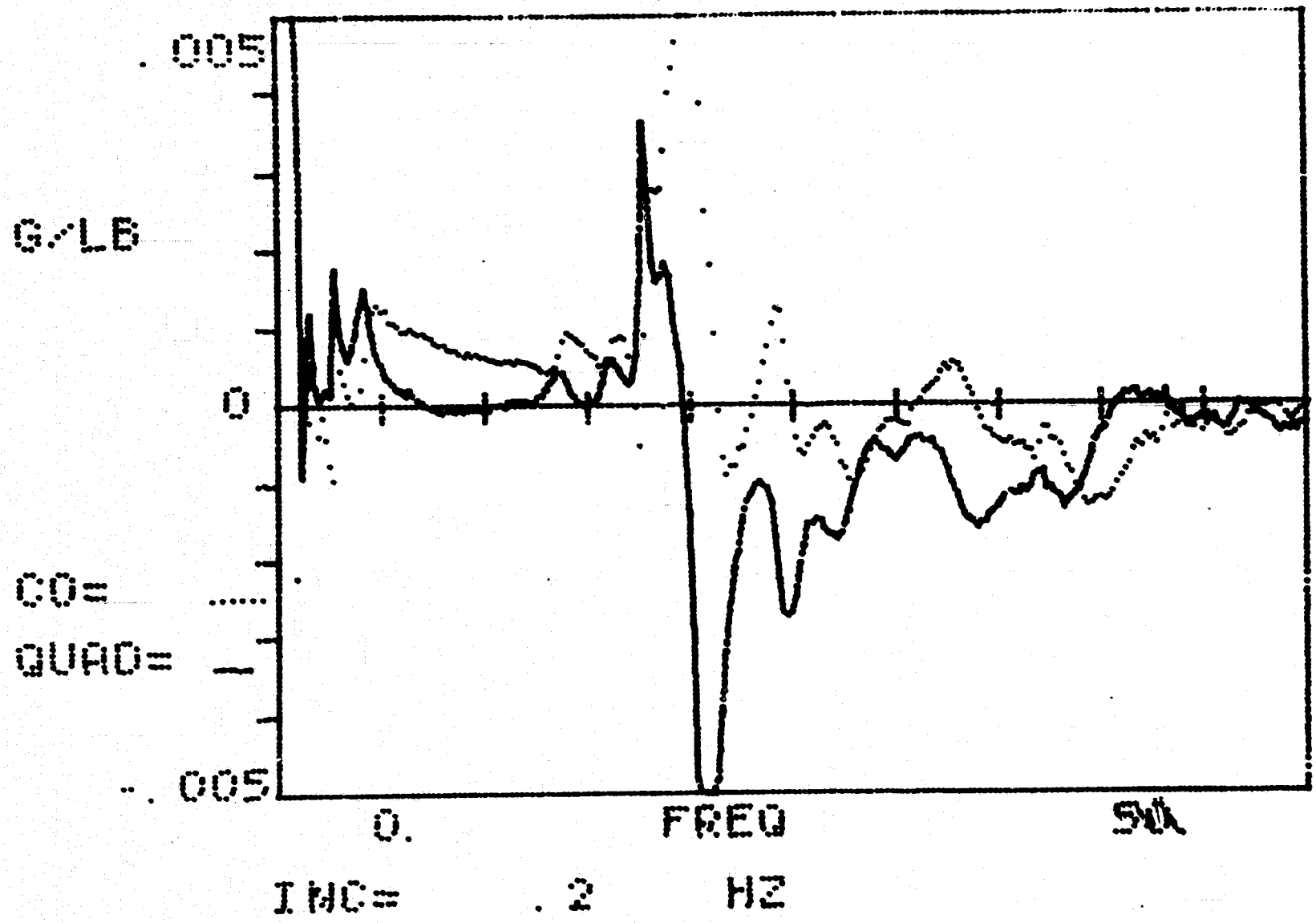
TAK TOM 12-2-74 RUN WF WB
AV17-F3



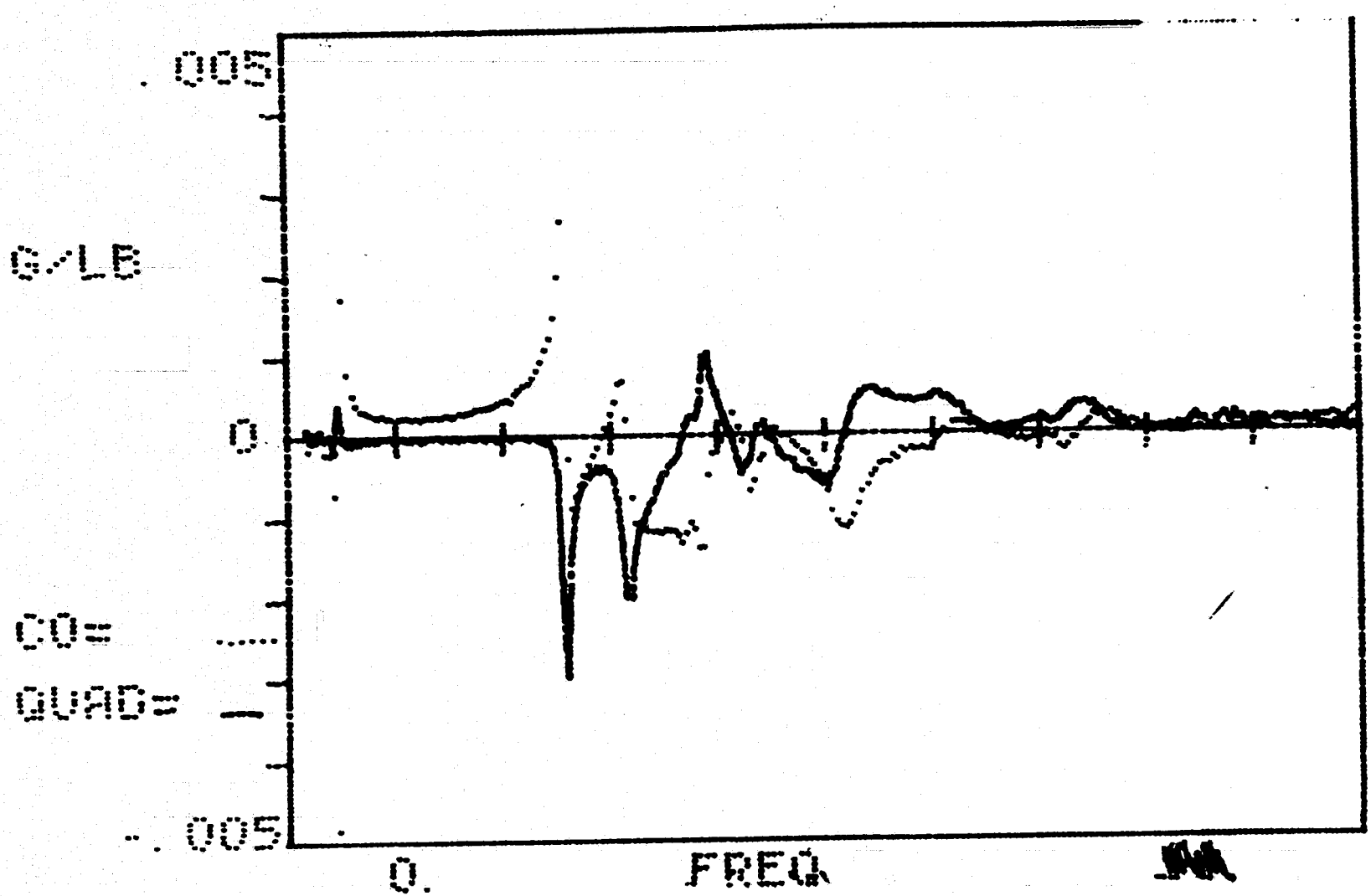
TRK TRN 12-2-74 RUN 47 WB
AV17/F3

C134

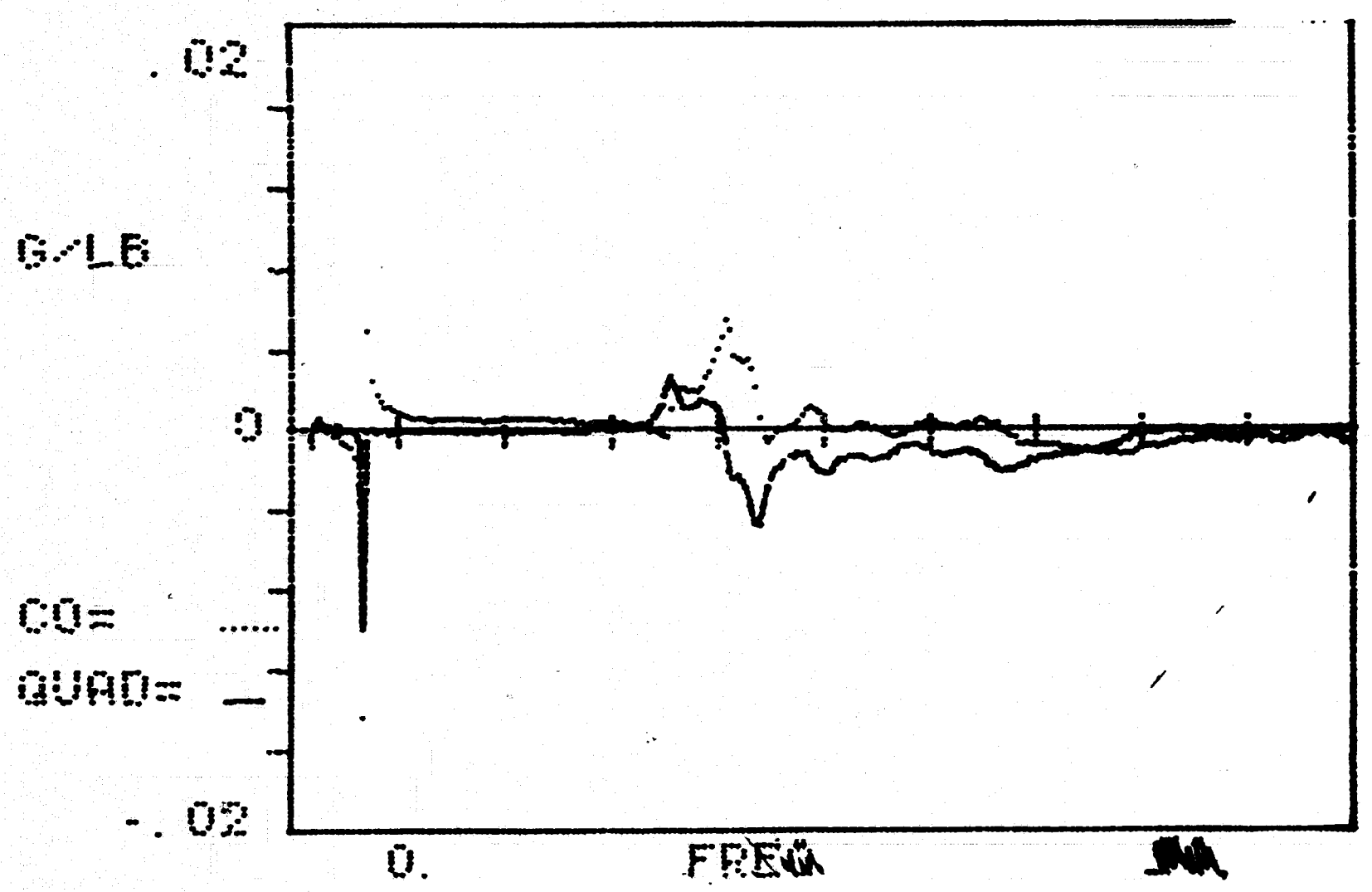

.01
G/LB
0
CO=
QUAD=
-.01
0.
FREQ
50.
INC= .2 HZ
TRK TRN 12-2-74 RUN 48 WB
AVG/F3



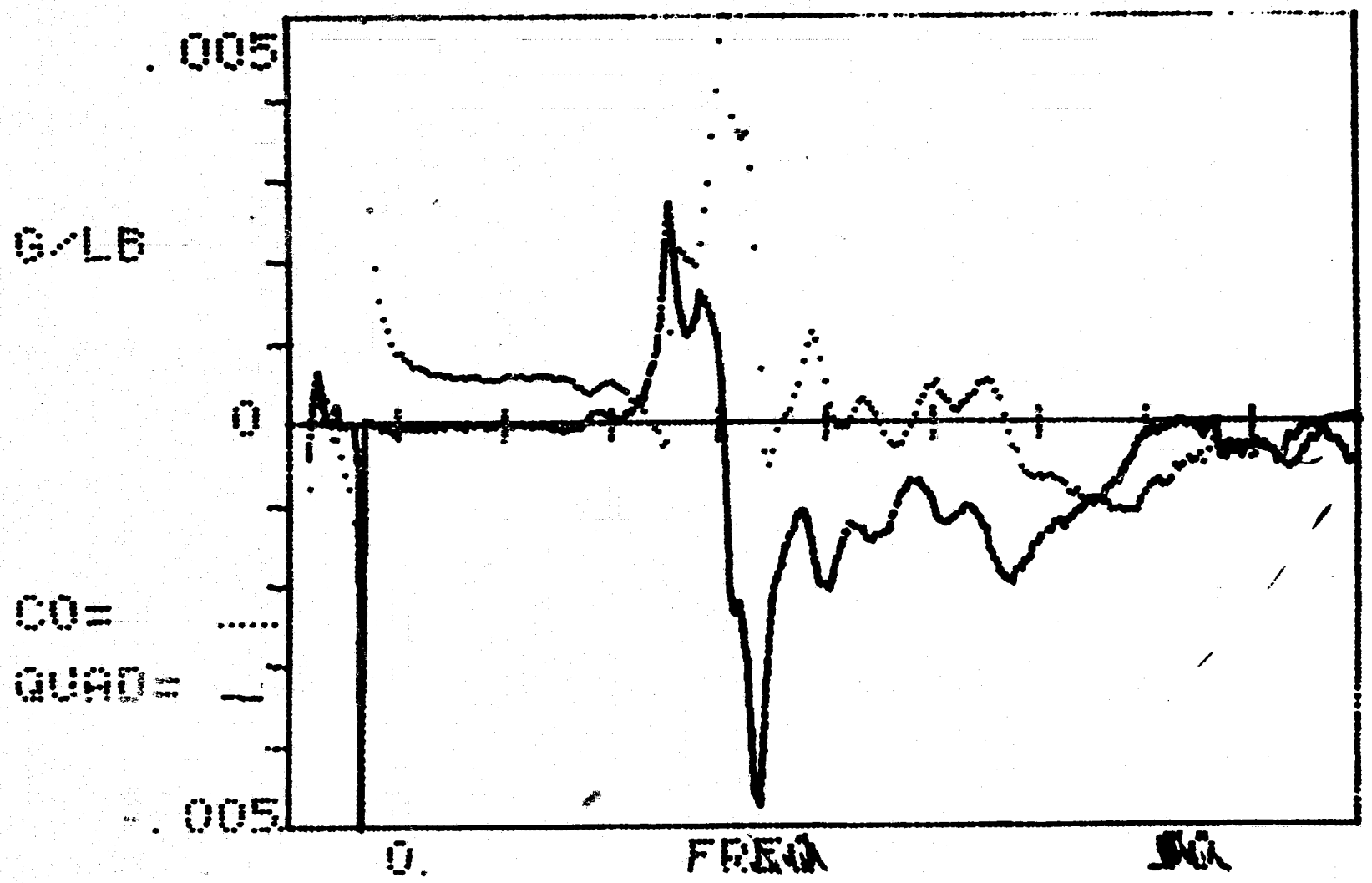
TRK TRM 12-2-74 RUN 48 WB
AVG/F3



TRK TRN 12-3-74 RUN 43 WB
AU12/F3

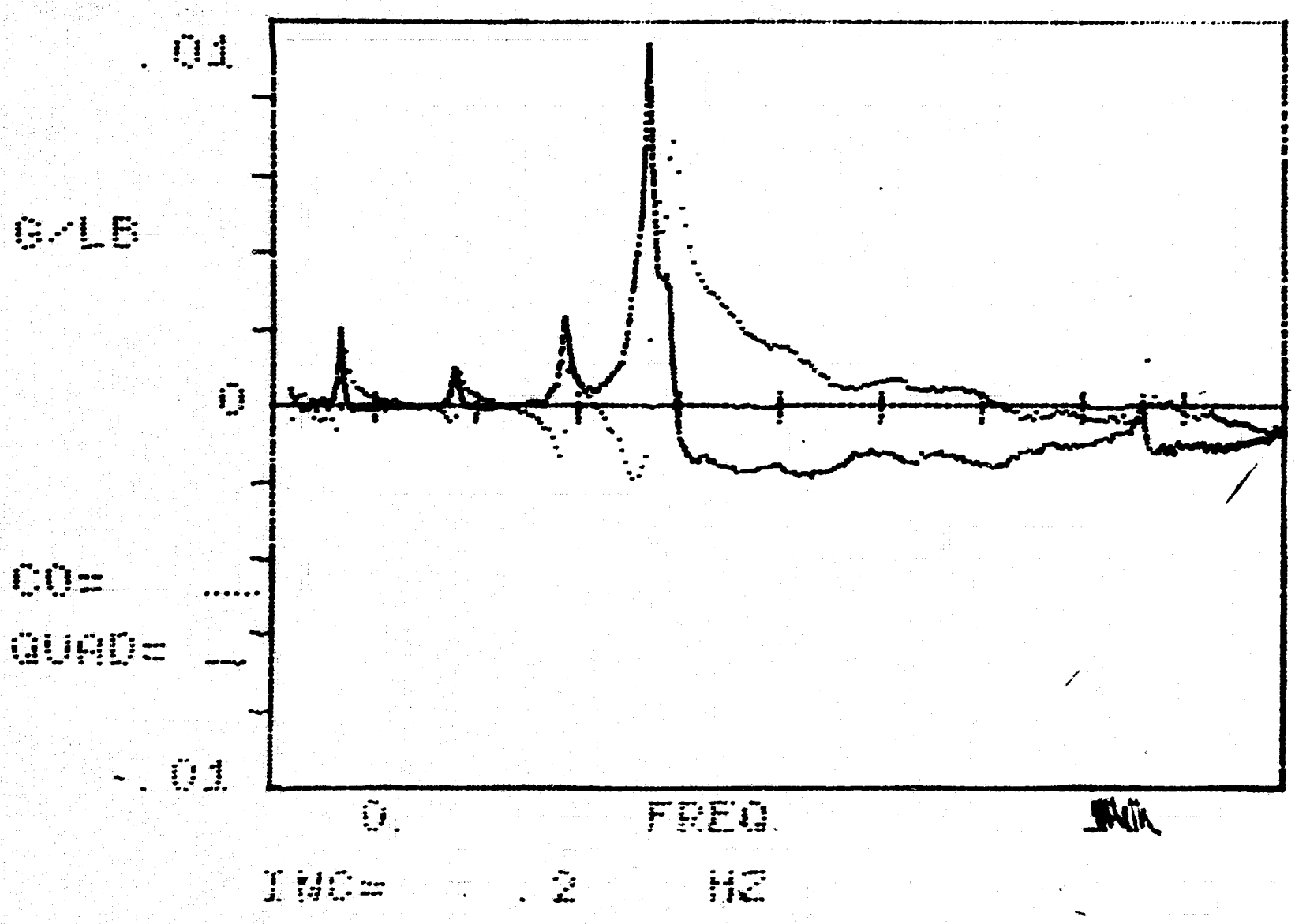


TRK TRW 12-3-74 RUN 50 WB
AVG/F3



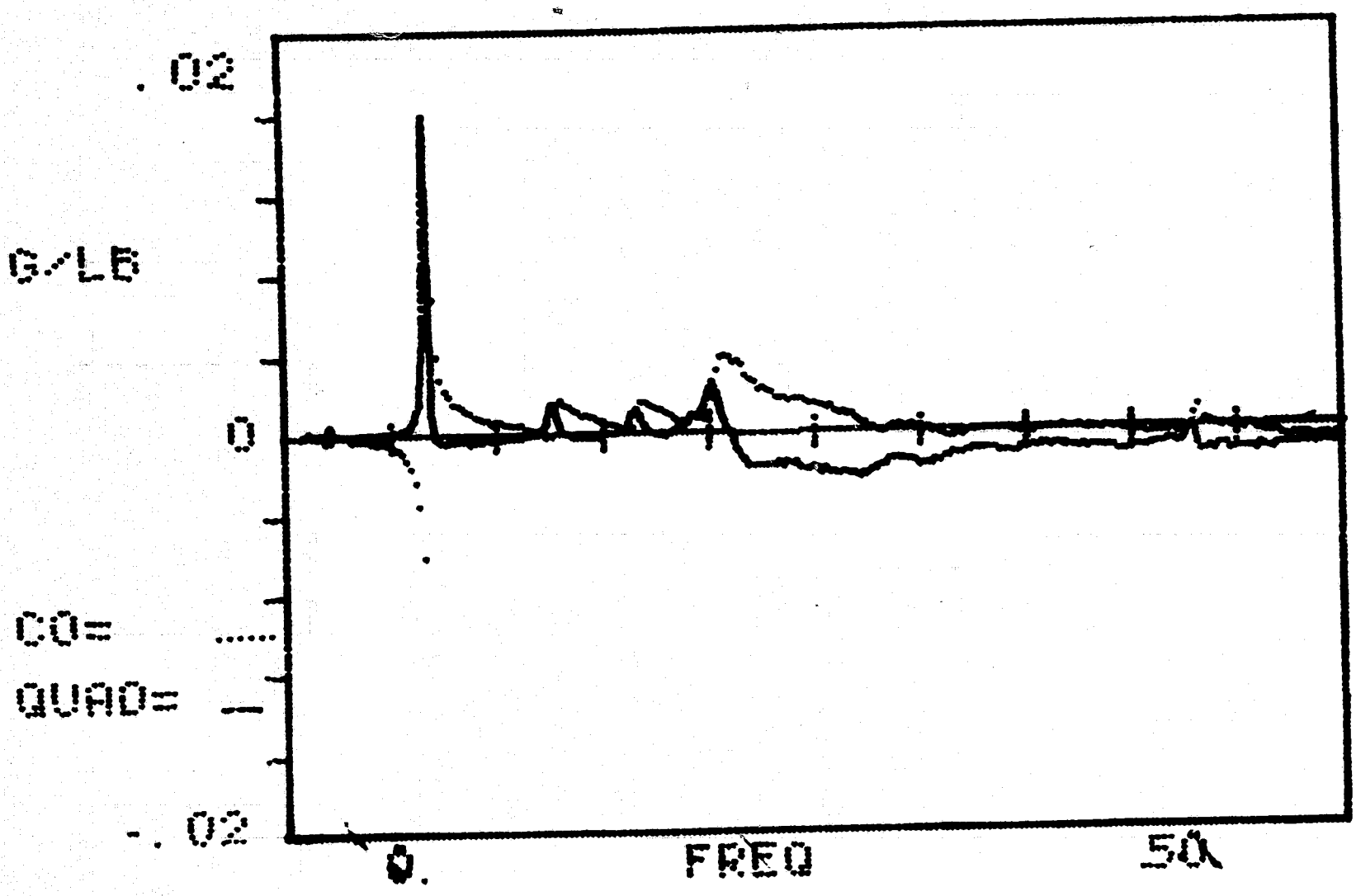
TRK TRN 12-3-74 RUN 50. HB
AUG-F3

C139

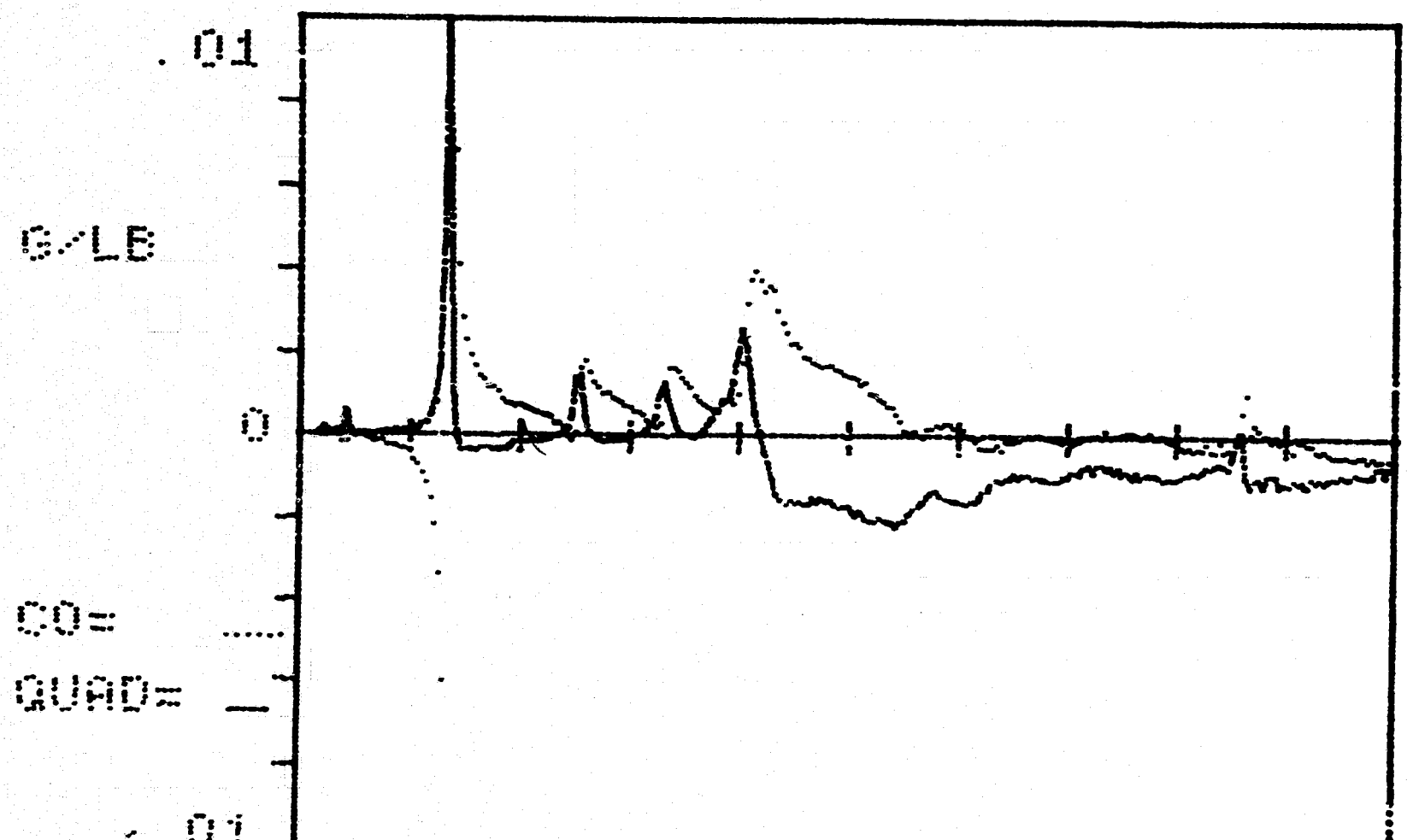


TRK TRN 12-3-74 RUN 51.WB
AU17/F3

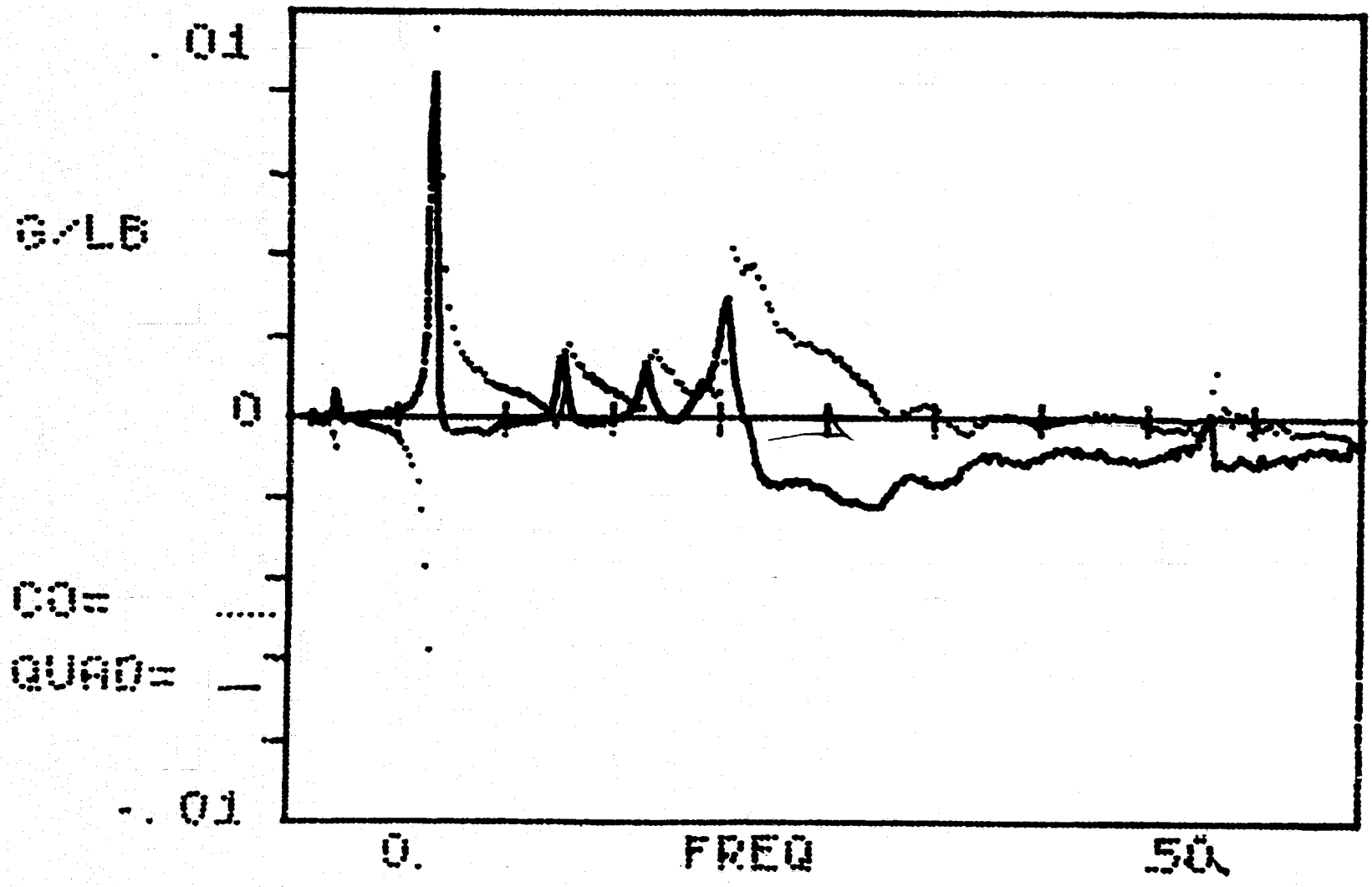
C140


.02
G/LB
0
CO=
QUAD=
-.02
0.
FREQ
50
INC= .2 HZ
TRK TRM 12-3-74 RUN 52 WE
AU17-F3

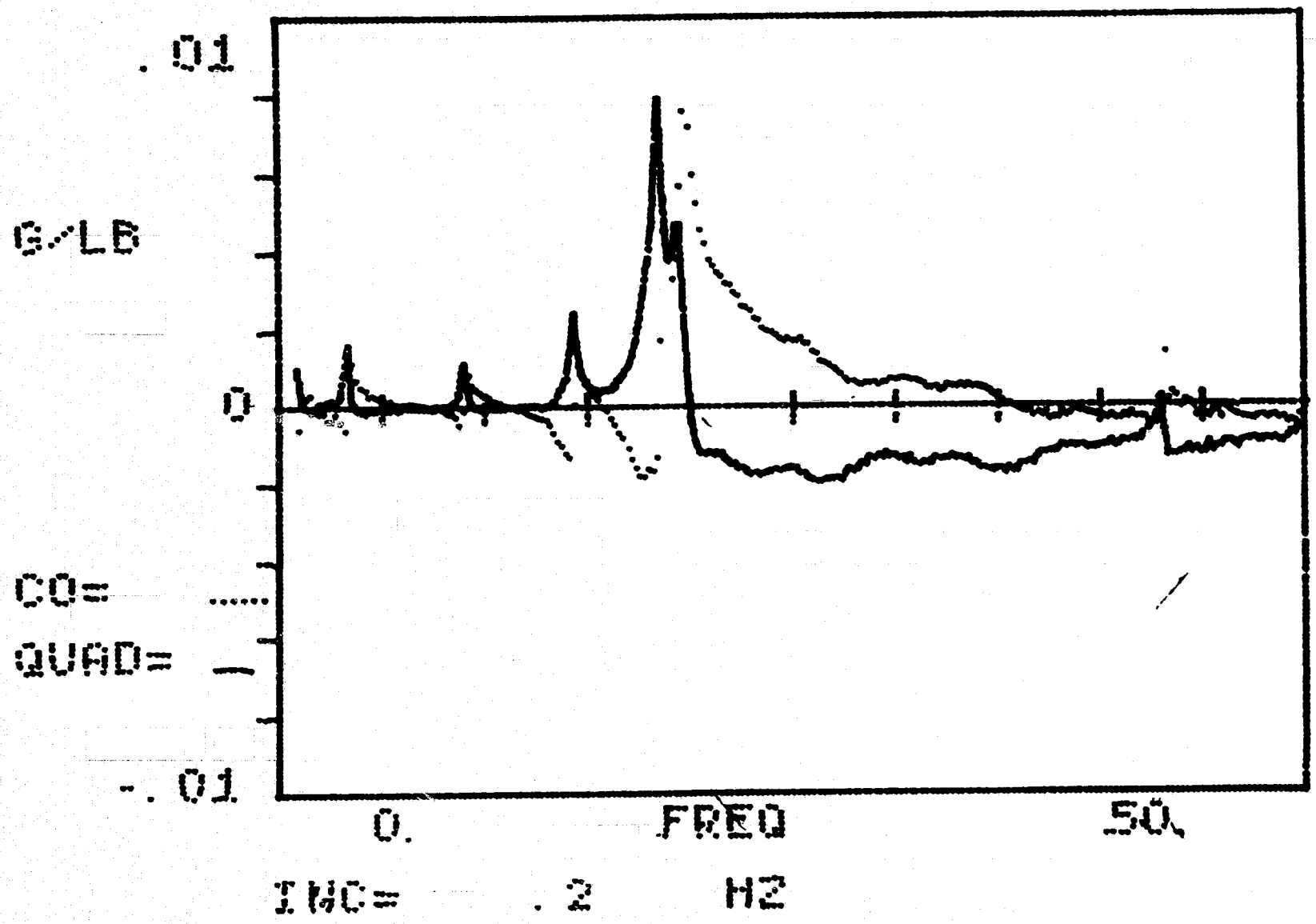
C141



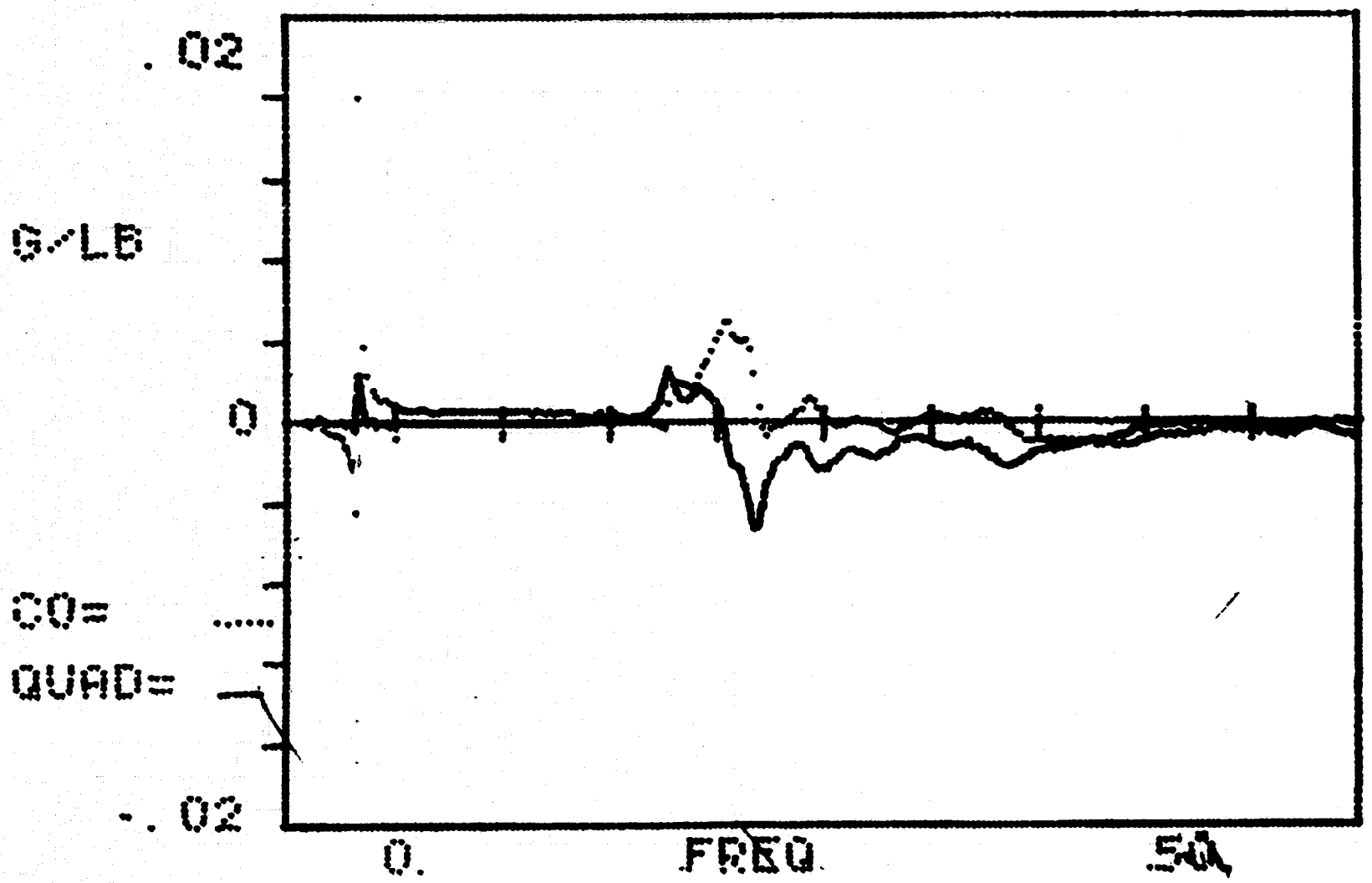
TRK TRN 12-3-74 RUN 52 WB
AV17-F3

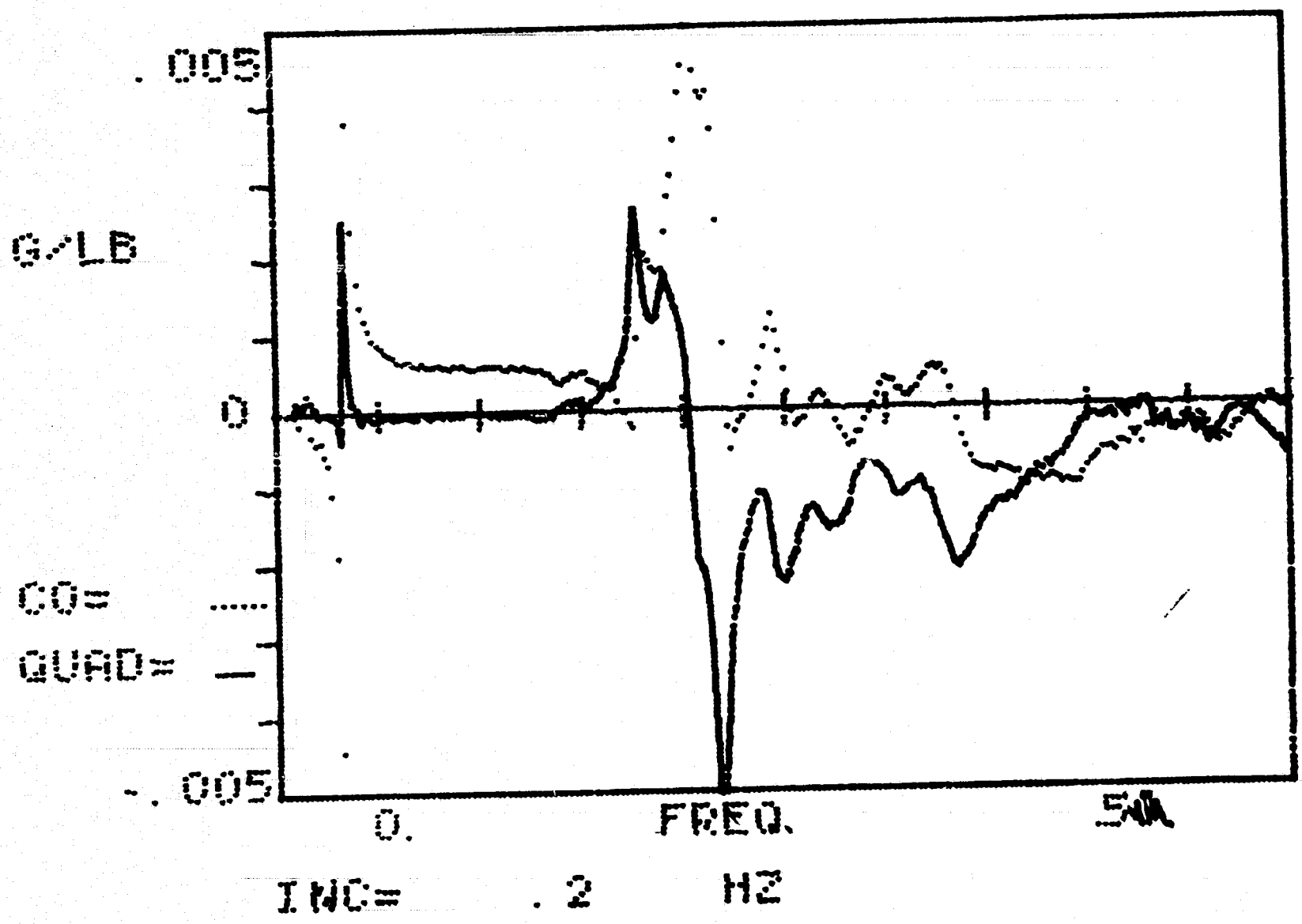


TRK TRN 12-3-74 RUN 53 WB
AV17²F3



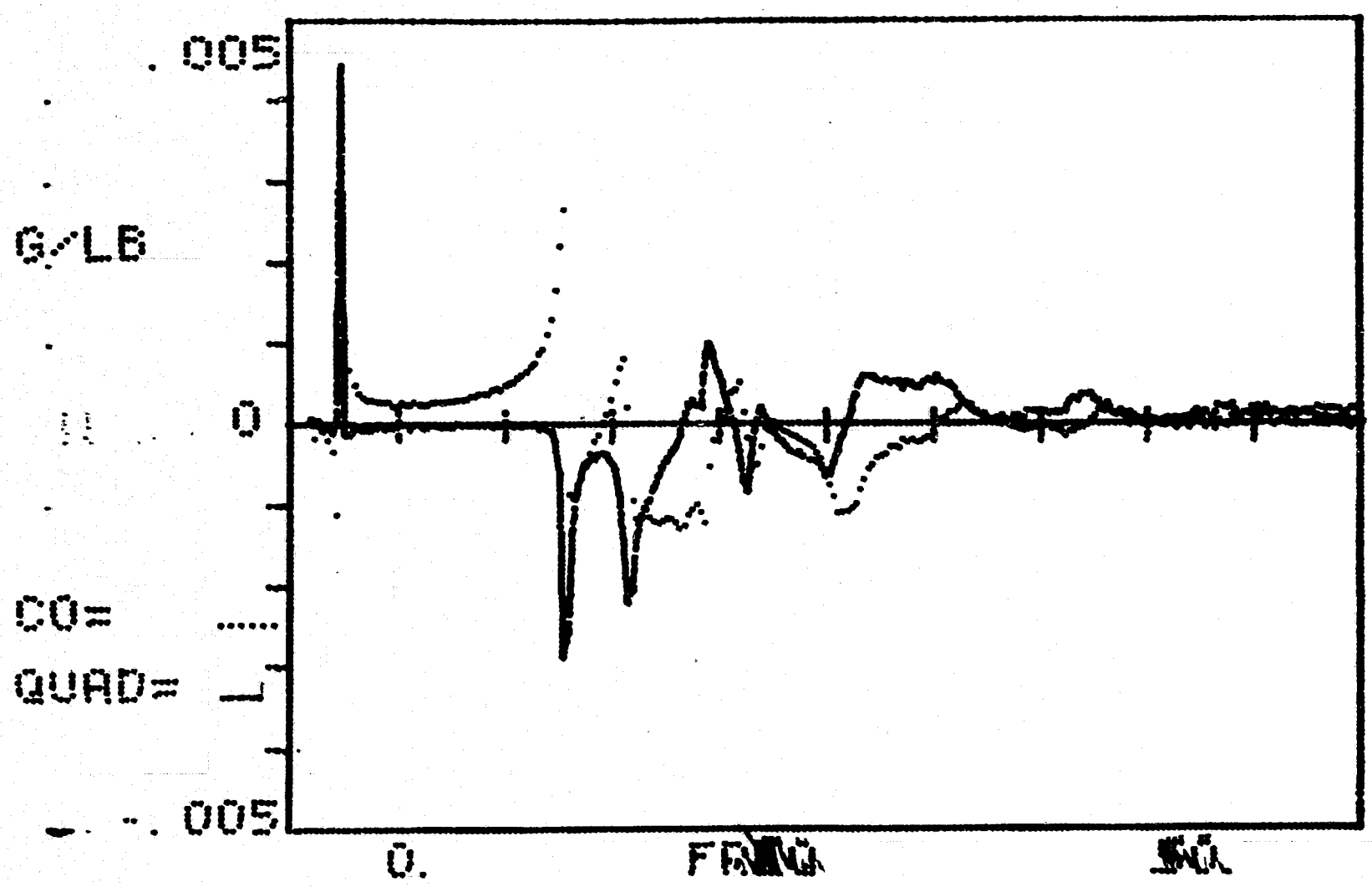
TRK TRM 12-3-74 RUN 54 WB
AV17/F3


.02
G/LB
0
CO=
QUAD=
-.02
0.
FREQ
50
INC= .2 HZ
TRK TRN 12-3-74 RUN 55 WB
BUG/F3



TRK TRM 12-3-74 RUN 55 WB
AVG/F3

C147
ORIGINAL PAGE IS
OF POOR QUALITY



TRK TRM 12-3-74 RUN 56 WB
AV12-F3

C148

APPENDIX D

MODAL SURVEY TEST REQUIREMENTS DOCUMENT
POST-TEST UPDATE*

*Note: paragraphs denoted with an "R" have been revised from the initial document release.

TRACK/TRAIN DYNAMICS

TEST REQUIREMENTS DOCUMENT

MODAL SURVEY

Contract NAS8-29882

Prepared by:

R. A. Vigil
Staff Engineer
Space Systems Dynamics

Approved by:

P. W. Abbott
Technical Director
Track/Train Dynamics

G. Morosow
Program Manager
Track/Train Dynamics

FOREWORD

This document is submitted in accordance with the requirements of NASA Contract NAS8-29882.

CONTENTS

	Page
Foreword	ii
Contents	iii
1.0 Introduction	1
1.1 Test Objectives	1
2.0 Description of Test Article	1
2.1 Test Configurations	1
3.0 Test Location and Facility Definition	2
4.0 Responsibilities and Support Requirements	2
4.1 Environmental Laboratory	2
4.2 Structures Laboratory	2
4.3 Dynamics	2
4.4 Safety	2
5.0 Test Requirements	2
5.1 Test Prerequisites	2
5.1.1 Instrumentation Frequency Requirements	2
5.1.2 Shaker Force Requirements	3
5.1.3 Force Multiplier Evaluation	3
5.2 Test Description	3
5.2.1 Wide Band Sweeps	3
5.2.2 Narrow Band Sweeps	3
5.2.3 Tuning and Modal Decays	3
5.2.4 Modal Dwells	3
5.2.5 Freight Car Roll Stop Evaluation	4
5.3 Instrumentation and Data Acquisition	4
5.4 Data Reduction	4

		Page
6.0	Results	4
	6.1 Test Data Report	4
	6.2 Data Retention	4

Figures

1	Test Article General Configuration	5
2	Test Setup and Configurations	6
3	Instrumentation Locations and Measurement Numbers	7

1.0 INTRODUCTION

This document defines the detailed requirements for the conduct of a Modal Survey Test (MST) on an 80 ton open hopper railroad freight car. The test program consists of obtaining modal survey data from three separate test configurations for comparison with the analytical model.

1.1 Test Objective - The basic objective of the MST is to obtain data for the refinement and verification of the freight car linear elastic model.

2.0 DESCRIPTION OF TEST ARTICLE

The test article is an L&N RR model M-042-174 freight car with ASF 11 trucks. Details concerning the test article general arrangement can be found in Figure 1.

2.1 Test Configurations - The test article will be subjected to sinusoidal forces during three separate test configurations as follows:

Configuration	Description
1	Empty freight car mounted on a serva-level air isolation system
2	Loaded freight car mounted on a serva-level air isolation system
3	Loaded freight car mounted on both truck assemblies with wheels chocked to test facility floor

These test configurations are illustrated in Figure 2.

3.0 TEST LOCATION AND FACILITY DEFINITION

The test will be conducted in the Structural Laboratory Low Bay area of the General Purpose Laboratory (GPL). Test support equipment

will be located in the enclosure near the test setup to afford this equipment maximum protection from coal dust, etc. (see Figure 2). The necessary utilities to accommodate test support equipment will be furnished by the test facility.

4.0 RESPONSIBILITIES AND SUPPORT REQUIREMENTS

4.1 Environmental Laboratory (0434) - Provide shaker systems, shaker control equipment, instrumentation, data acquisition/reduction equipment, accelerometer/force gage mounting hardware, stinger assemblies, procedure, test data report, and post-test procedure update.

4.2 Structures Laboratory (0436) - Provide facility, air suspension support stands, and mechanical force amplifier assemblies.

4.3 Dynamics - Provide pre-test analysis, test requirements document, post-test requirements document update, and final test report. Perform analytical model manipulation based on orthogonality checks, GMC comparisons and damping data.

4.4 Safety - Insure personnel safety.

5.0 TEST REQUIREMENTS

5.1 Test Prerequisites

5.1.1 Instrumentation Frequency Requirements - Perform a frequency evaluation on a sampling of proposed instrumentation from 0.5 to 50 Hz showing relative amplitude and phase data. At least two accelerometers and all force gages will be required to operate below 2 Hz. Rover techniques will be used to supplement transducer limitations.

R 5.1.2 Shaker Force Requirements - Verify that all shaker systems are capable of continuously delivering full rated force (125 pounds-peak). If additional force is required, a mechanical force multiplier will be used.

R 5.1.3 Force Multiplier Evaluation - An evaluation of the force multiplier will be conducted to determine its operating amplitude and frequency range.

5.2 Test

R 5.2.1 Wide Band Sweeps - Wide band sweeps will be conducted from 0.5 to 50 Hz using single or multiple shakers. CO/QUAD versus frequency plots will be required for each sweep. Frequency will be incremented linearly at 0.2 Hz.

R 5.2.2 Narrow Band Sweeps - Narrow band sweeps will be conducted around selected modal frequencies. Data will be presented optionally in CO/QUAD form. Plots will not be required where good modal separation exists. Instead, narrow band sweeps to verify mode separation will be accomplished by viewing lissajous patterns.

R 5.2.3 Tuning and Modal Decays - Fine tuning will be accomplished through the use of CO/QUAD values and lissajous patterns. Following the tuning exercise amplitude decays of a maximum of twelve selected transducers and the frequency synthesizer will be recorded on magnetic tape and a real time oscillograph recorder as required. Permanent oscillograph recordings of selected decays will be required as part of the data package. Decays will be accomplished by simultaneously opening the armature circuit of the shakers and shorting the oscillator drive signal.

5.2.4 Modal Dwells - Dwells will be conducted at selected modal frequencies and CO/QUAD tabulations will be obtained for all transducer locations. CO/QUAD data will subsequently be used to update the analytical model.

The above test sequence will be repeated for the three stated test configurations as defined in Section 2.1

R 5.2.5 Freight Car Roll Stop Evaluation - The freight car will be mechanically grounded at the roll stop locations. Data will be acquired with all four locations grounded and also, with two locations grounded simulating a roll condition. The data will be compared with ungrounded data.

5.3 Instrumentation and Data Acquisition - Instrumentation locations and measurement numbers are illustrated in Figure 3. Accelerometer and force gage mounting blocks will be installed using dental cement or an equivalent. The total number of transducers for this test are as follows:

Force Gages	6
R Fixed Accelerometers	42
Rover Accelerometer Locations	8

5.4 Data Reduction - Data reduction will be CO/QUAD plots and tabulations. In addition, both real time and permanent oscillograph recordings will be required for decay data.

6.0 RESULTS

R 6.1 Test Data Report - A test data report will be issued within 30 days after the completion of data reduction. This report shall include, but not be limited to the following:

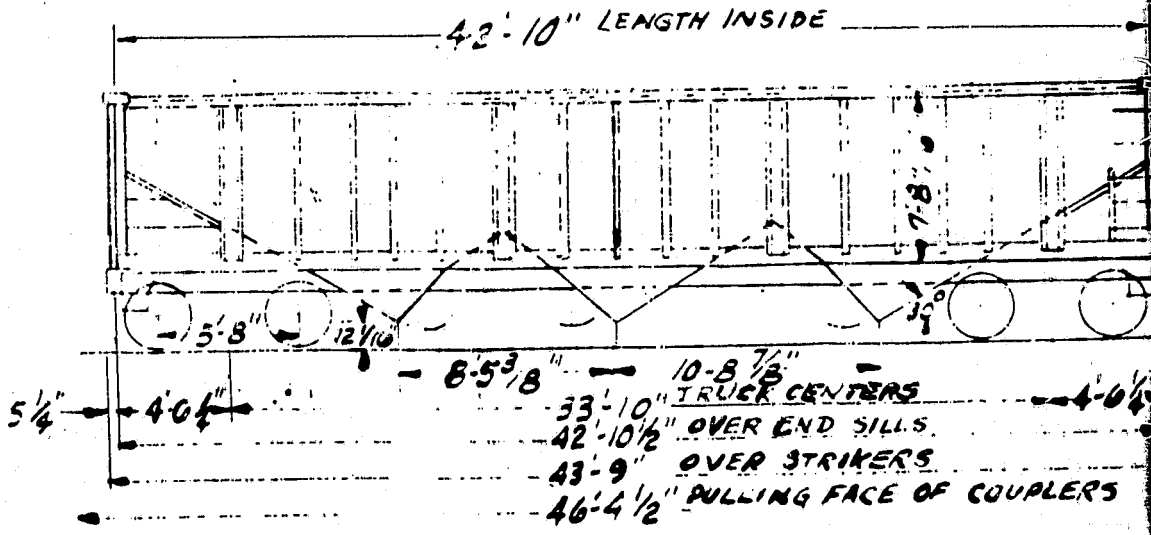
a. CO/QUAD plots and tabulations,

b. modal decay recordings,

c. photographs of test setup and instrumentation locations,

d. instrumentation log sheets (calibrations, channel and trace identification, etc.).

6.2 Data Retention - All quick look data, tapes and logs will be retained for 18 months after test completion.



GENERAL CAR DATA

Gen. Arrangement M-042-174	Copy. Cu. Ft. 2960
Brake Arrangement B-003-171	With 10 Heap Cu. Ft. 3200
AAR Class HT	Total Copy. Cu. Ft.
L&N Equip. Code 218	Ea. End Hopper Cu. Ft.
Built By P-5 Lot 9535	Center Hopper Cu. Ft.
Built or Rebl. OCT, NOV., 1971	Floor
Taken From	Floor Copy
Clearance Plate B	Lining Side or Interior
Curve Negotiability—with 40 6" car	Lining End
Average Lt. Wt. 53,200#	No. DF Belts
Average Ld. Lmt. 166,800#	No. Lading Anchors
Center of Gravity E-46.8" L-73.9"	Movable Bulkheads
Air Brakes ABD-1012	No Chain Tie Downs
Brake Regulator UNIVERSAL 1900-G	Stake Pockets Per Side
Hand Brake SEE NOTE 1.	Gates or Doors P-5
Cushioning	Running Boards
Coupler B-E60B-HT	Vibrator Attachment
Yoke B-Y40-HT	Roof
Draft Gear C-W MK-50	Running Board Cover
Striker FS-4372	Drop Ends
Back Stop & C. Filler FS-4384	Coiled Steel Cradles

80-TON

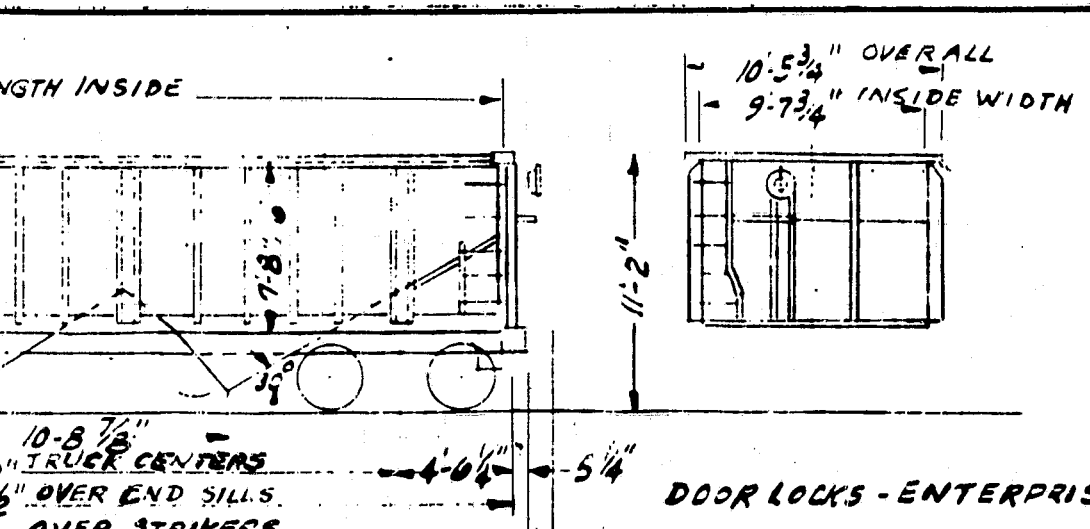
No. 140	Type A
Dwg.	Copy 6
Wt. 8860#	Bowl Dia.
Wheels 33" 1-W CAS	
Side Frame FS-4294	
Bolster FS-4416	
Bowl Wear Plate	
Bowl Wear Ring	
Live Lever 8"X1/4"	
Dead Lever 8 X1/4"	
Bottom Rod (UNDER) 120	
TRUCK SPRINGS PER	
Outer 10 D-5	
Inner 6 D-5	
Snubber HOLLAND D	
Shock Absorber	
RIDE CONTROL SPRGS.	
Outer 4 ASF DWG. 54	
Inner	
Side	
Friction Casting	

FIGURE 1. TEST ARTICLE GENERAL CONFIGURAT

FOLDOUT FRAME /

ORIGINAL PAGE IS
OF POOR QUALITY

80-TON HOPPER CARS



DOOR LOCKS - ENTERPRISE SCHEDULE 2303-G

80-TON TRUCK DATA

No. 140	Type A-3	Side Bearing 6056-C STUCKI	
Dwg.	Copy 6"X11"	Journals ROLLER BEARINGS	
Wt. 8860#	Bowl Dia. 1/4"	Pad Adapter FS-4282, E-21744	
Wheels 33" 1-W CAST STL.		Axles 6"X11"	
Side Frame FS-4294		Brake Beams #18 A.S.F. UNIT	
Bolster FS-4416 ALSO SEE NOTE 2		Brake Shoes AAR H-4-A	
Bowl Wear Plate		Trk Mounted Brakes	
Bowl Wear Ring			
Live Lever 8"X1/4" 1185 *			
Dead Lever 8 X1/4" 1185 *			
Bottom Rod (UNDER) 120-380-B *			

TRUCK SPRINGS PER TRUCK

Outer 10	D-5
Inner 6	D-5
Snubber HOLLAND	D-5
Shock Absorber	

RIDE CONTROL SPRGS. PER TRK.

Outer 4 ASF DWG. 54222	
Inner	
Side	
Friction Casting	

MISCELLANEOUS

1. UNIVERSAL: 186200-186399
KLASING: 186400-186499
2. 50 CARS EQUIPPED WITH INVERTED TRUCK BOLSTERS
LETTER 1-12-73 FILE 30-2 F. 208
PATT. FS-4432.

300 186200-186499

NO. CARS _____ CAR SERIES _____

L & N R. R. CO.
MECH. ENGINEERS OFFICE
LOUISVILLE KY.

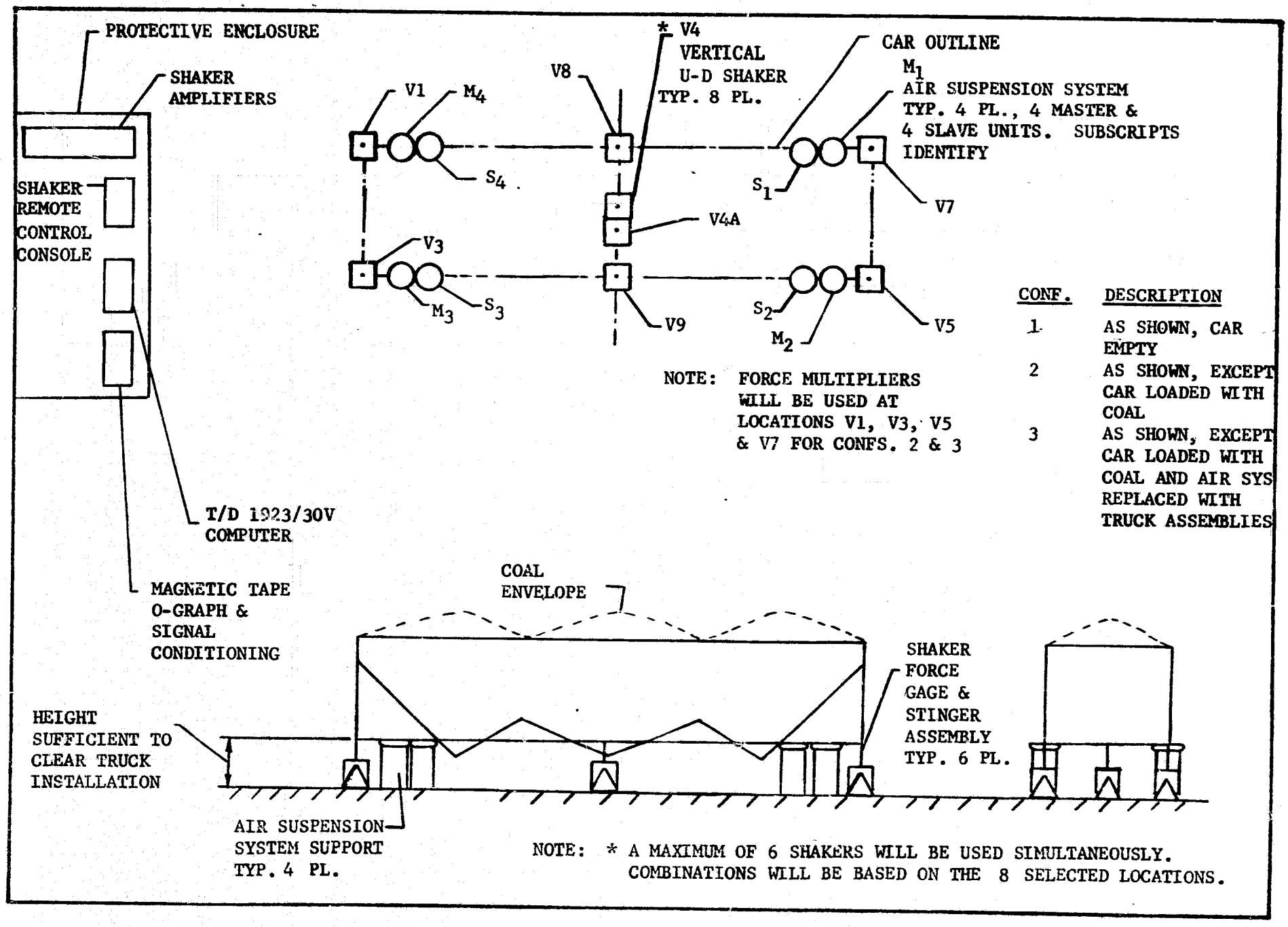
David Orr, Engr., Mech. Systems Devel.
L&N R.R., 908 W. Broadway, Louisville 40201

REVISION A

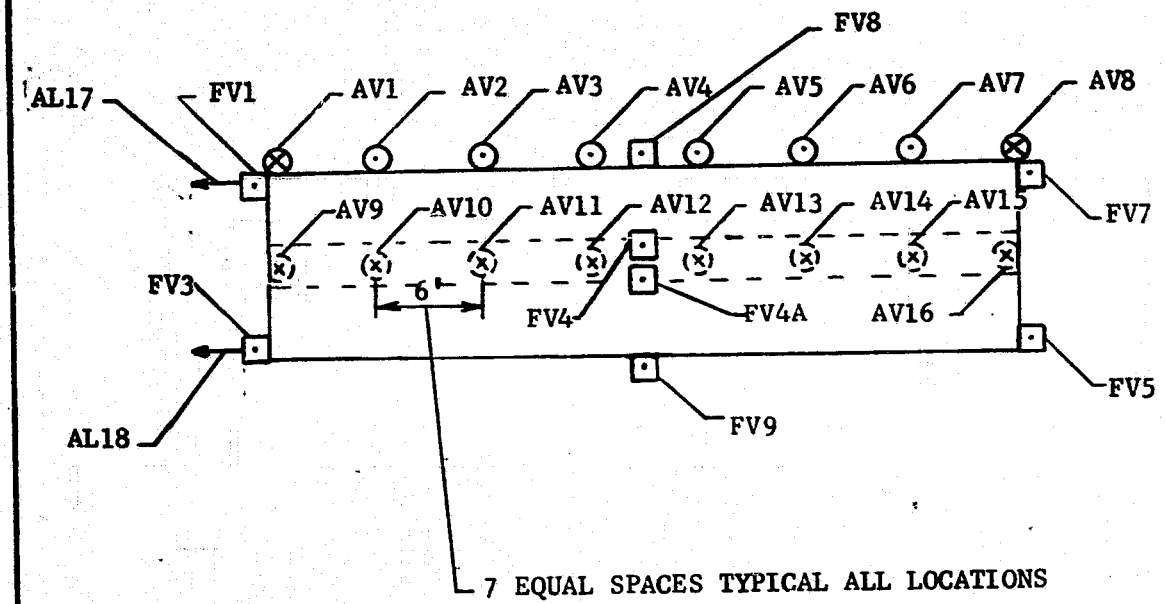
SHEET NO. H-42-1

TEST ARTICLE GENERAL CONFIGURATION

FOLDOUT FRAME 2



R FIGURE 2. TEST SETUP AND CONFIGURATIONS



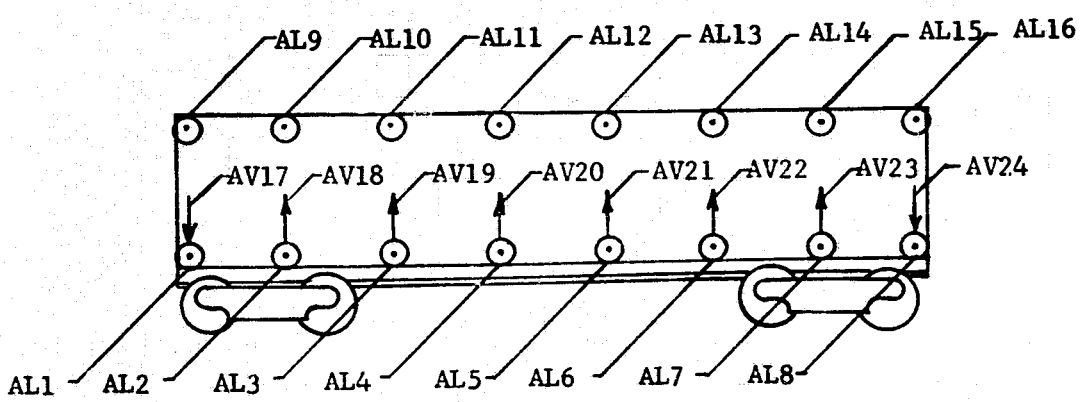
TRANSDUCER LOCATIONS

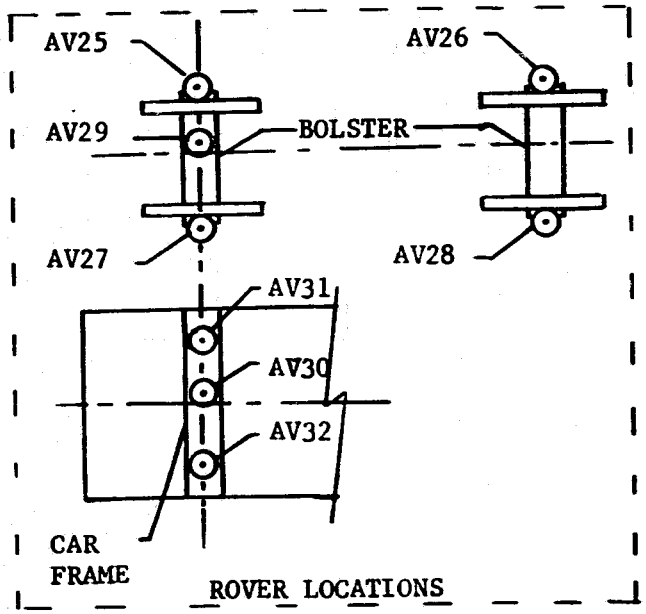
ACCELEROMETERS	50
(2) FORCE GAGES	8

NOTES:

(1) TRANSDUCERS NOT SHOWN IN ALL VIEWS

(2) ONLY SIX FORCE MEASUREMENTS WILL BE OBTAINED SIMULTANEOUSLY





D12
7

R

FIGURE 3. INSTRUMENTATION LOCATION AND MEASUREMENT NUMBERS

APPENDIX E

MODAL SURVEY TEST PROCEDURE
POST-TEST UPDATE

NOTE: paragraphs which are denoted with an "R" have been revised from the initial document release.

TRACK/TRAIN DYNAMICS
TEST PROCEDURE
MODAL SURVEY

Contract NAS8-29882

Prepared by:

R. A. Vigil
Staff Engineer
Space Systems Dynamics

Approved by:

P. W. Abbott
Technical Director
Track/Train Dynamics

J. T. Osmanski
Section Chief
Environmental Laboratory

G. Morosow
Program Manager
Track/Train Dynamics

R. L. Lyon
Unit Head
Structures Laboratory

MARTIN MARIETTA CORPORATION
Denver Division
Denver, Colorado 80201

FOREWORD

This document is submitted in accordance with the requirements of NASA Contract NAS8-29882.

CONTENTS

	Page
Foreword	ii
Contents	iii, iv
1.0 SCOPE	1
1.1 Purpose	1
1.2 Summary	1
2.0 TEST CONFIGURATIONS	1
2.1 Configuration 1	1
2.2 Configuration 2	1
2.3 Configuration 3	1
3.0 SUPPORT REQUIREMENTS	1
3.1 Handling Equipment	1
3.2 Test Equipment	1
3.3 Reference Documents	2
3.4 Facility Requirements	2
4.0 SPECIAL CONSIDERATIONS	2
4.1 Cautions and Warnings	2
4.2 Test Discrepancies	2
4.3 Safety	2,3
4.4 Procedure Changes	3
4.5 Test Personnel	3
4.6 Test Log	3
4.7 Test Data	3
4.8 Test Control Board	3,4
5.0 OPERATIONS	5
5.1 Prerequisites	5
5.2 Preparations	5
5.3 Detailed Operations	5-9
5.4 Post-Test Review	9
5.5 Post-Test Disassembly	9
6.0 ABBREVIATIONS AND ACRONYMS	10,11
7.0 FIGURES	12-15
7.1 Test Setup and Configurations	12
7.2 Instrumentation Location and Measurement Numbers	13
7.3 Test Instrumentation and Control System Block Diagram	14
7.4 Shaker Stinger Assembly	15
7.5 Force Multiplier Assembly	15a,b,c

CONTENTS (continued)

		Page
8.0	TABLES	16-22
	8.1 Handling Equipment	16
	8.2 Test Equipment	17,18
	8.3 Instrumentation Setup Sheet	19-21
	8.4 Test Historical Log	22

1.0 SCOPE

This procedure provides the necessary information and detailed steps required to conduct a modal survey vibration test on an 80 ton open hopper freight car.

1.1 Purpose - The basic objective of the modal survey test is to obtain data for the refinement and verification of the freight car linear elastic model.

1.2 Summary - The test configurations, handling, test facilities, test operations, and data acquisition/reduction activities necessary to meet the conditions of the test requirements document are delineated herein.

2.0 TEST CONFIGURATIONS

2.1 Configuration 1 - The empty freight car will be mounted on an air suspension system and tested in a free-free condition.

2.2 Configuration 2 - The freight car will be loaded with coal and tested in a free-free condition.

2.3 Configuration 3 - The air suspension system will be replaced with the ASF-11 trucks and tested in a fixed-free condition.

3.0 SUPPORT REQUIREMENTS

3.1 Handling Equipment - The support equipment necessary to move the freight car, shakers, and coal is listed in Table 8.1.

3.2 Test Equipment - The support equipment necessary to conduct the test is listed in Table 8.2.

R 3.3 Reference Documents

3.3.1 P74-48338-1, "Track-Train Dynamics Analysis and Test Program", Update

3.3.2 TS-002-MS, "Track/Train Dynamics Test Requirements Document Modal Survey"

3.3.3 LAB 1007302, "Track-Dynamic Analysis GVS Test"

3.3.4 D5W247 , Barry Controls Air Serva-Level Operations Manual

3.3.5 1923-0100 , Time Data Operations Manual

R 3.4 Facility Requirements

3.4.1 115 VAC, 60 Hz, 1 Ø

3.4.2 440 VAC, 60 Hz, 3 Ø

3.4.3 Shop Air 115 psig minimum or equivalent

4.0 SPECIAL CONSIDERATIONS

4.1 Cautions and Warnings - The description appearing within a CAUTION or WARNING precedes the information that it is intended to emphasize. A CAUTION is used to prevent personnel from damaging equipment. A WARNING is used to prevent test personnel from endangering their safety or that of others. Each step of this procedure shall be read completely before proceeding with the action.

4.2 Test Discrepancies - A test discrepancy shall be logged and reported when test performance and/or results are affected.

4.3 Safety - MMC supervision are directly responsible for the safety of all personnel, safe working conditions and the implementation of all safety requirements applicable to this procedure.

4.3.1 All test team members are responsible for adhering to normal safety standards and procedures. They are also responsible for advising of any unsafe acts or conditions observed during preparation for or during conduct of this procedure.

4.3.2 Personnel safety will be notified 24 hours prior to the official test start date. This test is classified as having non-destructive potential.

4.4 Procedure Changes - All changes to this procedure will be documented and added to a post-test procedure update.

4.5 Test Personnel

Code	Description	Quantity
TD	Technical Director	1
TE	Test Engineer	1
MT	Mechanical Technician	2
ET	Electronic Technician	2
SF	Safety	1

4.6 Test Log - A test log shall be maintained during the test and shall contain information for a complete historical chronological description of test activities.

4.6.1 Instrumentation setup sheets shall be maintained and form part of the test log.

4.7 Test Data - Provision shall be made to retain all test data for a period of 18 months after the test completion.

4.8 Test Control Board - A test control board (TCB) shall periodically monitor test activities and shall consist of the

following personnel:

Name	Title	Function
G. Morosow	Project Manager (MMC)	Chairman
P. Abbott	Technical Director (MMC)	Member
J. Macpherson	Technical Representative (NASA/MSFC)	Member

STEP NO.	RESPONS-IBILITY	CK	ACTION	REMARKS
5.0			OPERATIONS	
5.1			Prerequisites	
5.1.1	TE	___	Verify that the instrumentation frequency evaluation is completed and the results documented.	
5.1.2	TE	___	Verify that the shaker system has been evaluated and is capable of delivering 125±1.5 db pounds peak force per shaker between 0.5 and 50 Hz.	
5.2			Preparations	
5.2.1	MT	___	Install air suspension system and supports per Barry Operations Manual and LAB 1007302 as shown in Figure 7.1.	
5.2.2	MT	___	Install car on air suspension system per LAB 1007302.	
5.2.3	MT	___	Adjust height sensing assemblies per Barry Manual.	
5.2.4	MT	___	Apply air to the suspension system and level car by fine adjustment of the height assemblies.	
			NOTE When the car is level and on air it	

	STEP NO.	RESPONSIBILITY	CK	ACTION	REMARKS
				should be free to move vertically without interference approx. ¼ inch from the rest position. Shims may be required at pedestal locations in order to accomplish this condition. A standard carpenters bubble is adequate for leveling operations.	
				CAUTION Return the freight car to the rest position when testing is discontinued.	
R	5.2.4a	TE/et al		Perform force multiplier eval. per TD.	
R	5.2.5	MT	___	Install shakers at positions V1, V3, V4, V5 and V7 per Figure 7.1.	
	5.2.6	MT	___	Install shaker stinger assemblies per Figure 7.4. Allow for ¼ inch height change when car is on air.	
	5.2.7	MT	___	Bond accelerometer mounting blocks to the car and install all instrumentation per Figure 7.2 and Table 8.3.	
	5.2.8	ET/MT	___	Setup shaker controls, air suspension controls, and data acquisition/reduction equipment in the protective enclosure and connect all cabling and plumbing per Figures 7.1 and 7.3.	

STEP NO.	RESPONS-IBILITY	CK	ACTION	REMARKS
5.2.9	ET	___	Checkout data acquisition equipment, tap check transducers, perform full scale calibrations, record calibrations on recorders and log information in Table 8.3.	
5.2.10	ET	___	Load CO/QUAD program in Time Data 1923/30V computer and verify operation per Time Data Operation Manual.	
R 5.2.11	ET	___	Verify equipment calibration.	
5.3			Detailed Operations	
			Configuration 1	
R 5.3.1	TE/et al	___	Perform wide band sweeps per TD instruction, relocating shakers and instrumentation as required to cover the 8 shaker locations per Figure 7.1. Increment frequency linearly at 0.2 Hz.	
5.3.2	TD	___	Review wideband sweep data and establish shaker locations for target modes.	
5.3.3	TE/et al	___	Perform narrow band sweeps around target mode frequencies and verify mode isolation. Obtain CO/QUAD plots as required.	

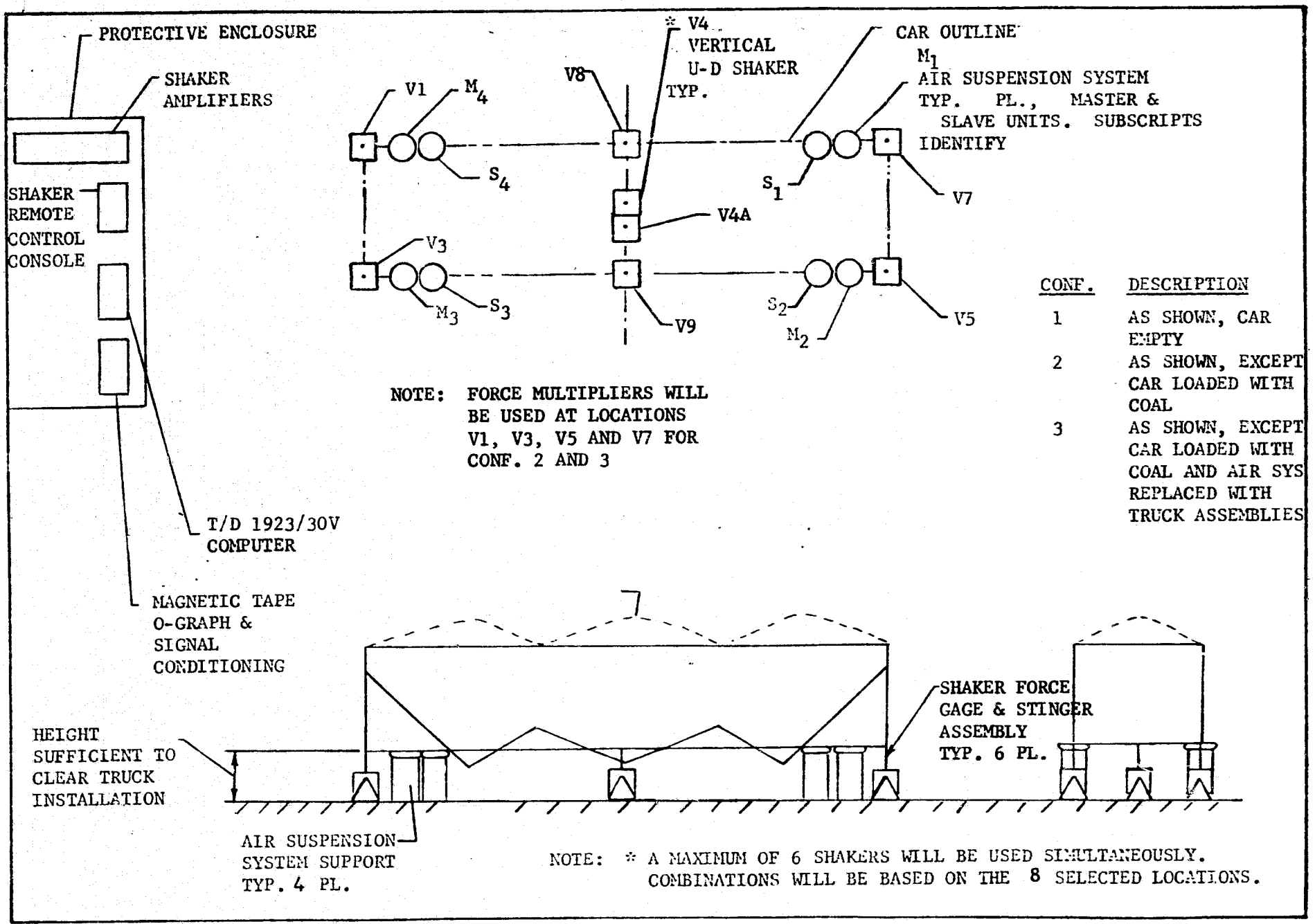
	STEP NO.	RESPONS-IBILITY	CK	ACTION	REMARKS
R	5.3.4	TE/et al.	___	Fine tune modal frequencies based on CO/QUAD values and Lissajous patterns per TD instruction.	
R	5.3.5	TE/et al.	___	Obtain decay data at established modal frequencies from selected measurements by simultaneously opening the armature circuit and shorting the drive signal of each shaker.	
	5.3.6	TE/et al.	___	Repeat tuning exercise if beating is indicated in the decay data or as directed by TD.	
	5.3.7	TE/et al.	___	Perform modal dwells at each selected modal frequency and obtain CO/QUAD values for all transducer locations.	
	5.3.7a	TE/et al	___	Record decays on magnetic tape.	
	5.3.8	ET	___	Reduce decay data from selected modes and measurements on permanent oscillograph recording paper.	
	5.3.9	MT	___	Photograph the test setup and shaker/transducer locations.	
				<u>Configuration 2</u>	
R	5.3.10	MT	___	Load car with coal and cover with polyethelene if required to reduce coal dust in the test area.	

STEP NO.	RESPONS-IBILITY	CK	ACTION	REMARKS
5.3.11	TE/et al	___	Repeat steps 5.3.1 through 5.3.9.	
			Configuration 3	
5.3.12	MT	___	Remove air suspension system and install ASF-11 truck assemblies per LAB 1007302.	
5.3.13	TE/et al	___	Repeat steps 5.3.1 through 5.3.9.	
5.4			Post-Test Review	
5.4.1	TCB	___	A post-test review by the TCB will be conducted prior to test termination to verify that test objectives have been met.	
5.5			Post-Test Disassembly	
5.5.1	TE	___	Obtain TCB approval to proceed with test disassembly.	
R 5.5.2	MT/ET	___	Remove all instrumentation and cables from the freight car and prepare the car for transfer function test.	
5.5.3	TE	___	Prepare a data package containing all logs, setup sheets, photographs and data, and submit to the TD.	

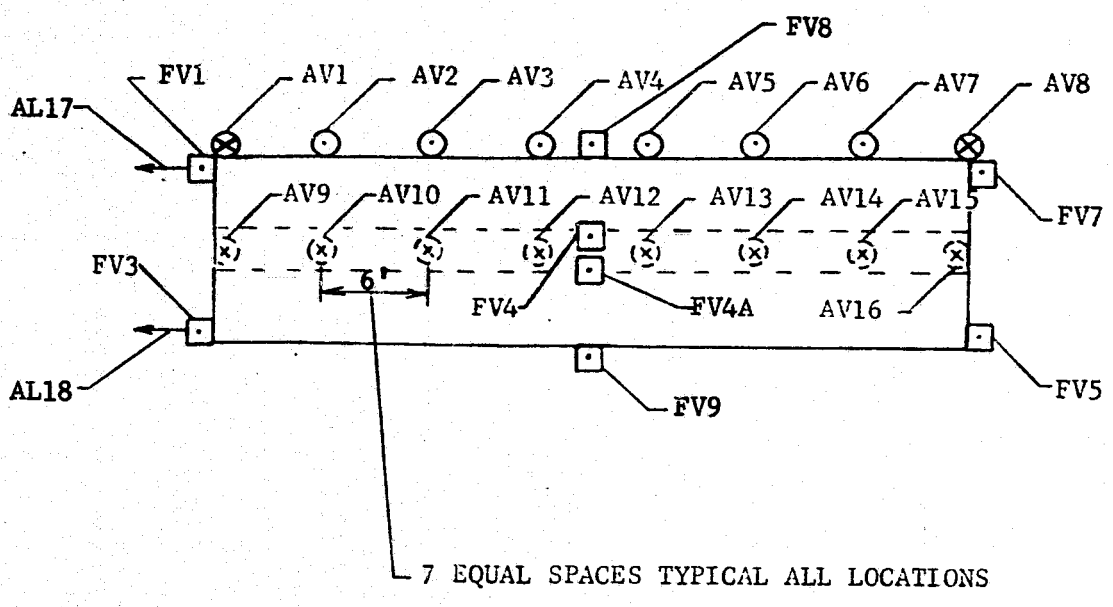
6.0 ABBREVIATION AND ACRONYMS

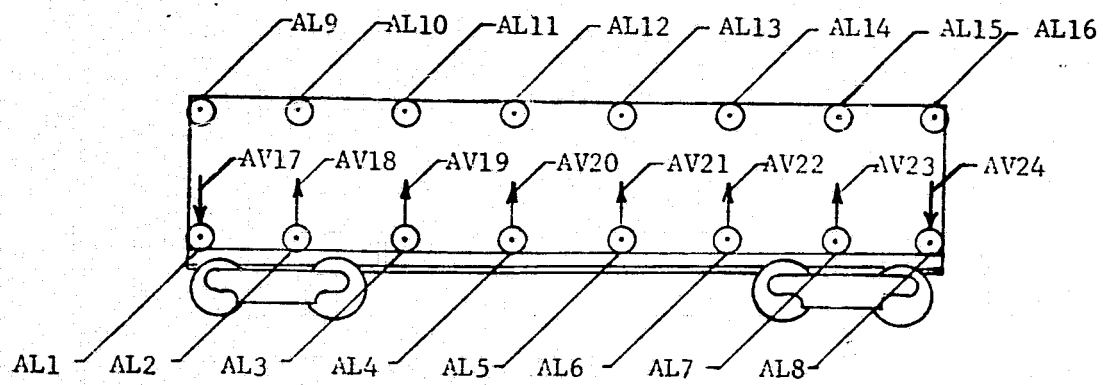
Calib.	Calibration
Cap.	Capacity
CDC	Control Data Corporation
Ch.	Channel
Ck.	Check
CO	Coincidence Component
ET	Electronic Technician
FS	Full Scale
GVS	Ground Vibration Survey
Meas.	Measurement
Mfg.	Manufacturer
MMC	Martin Marietta Corporation
MSFC	Marshall Space Flight Center
MT	Mechanical Technician
NASA	National Aeronautics and Space Administration
No.	Number
O-Graph	Oscillograph
Osc.	Oscillator
Qty.	Quantity
QUAD	Quadature Component
Sens.	Sensitivity
SF	Safety
SW	Switch
TCB	Test Control Board
TD	Technical Director

TE	Test Engineer
TTY	Teletype Terminal
Typ.	Typical
U-D	Unholtz-Dickie Corporation
XDCR	Transducer



R FIGURE 7.1 TEST SETUP AND CONFIGURATIONS





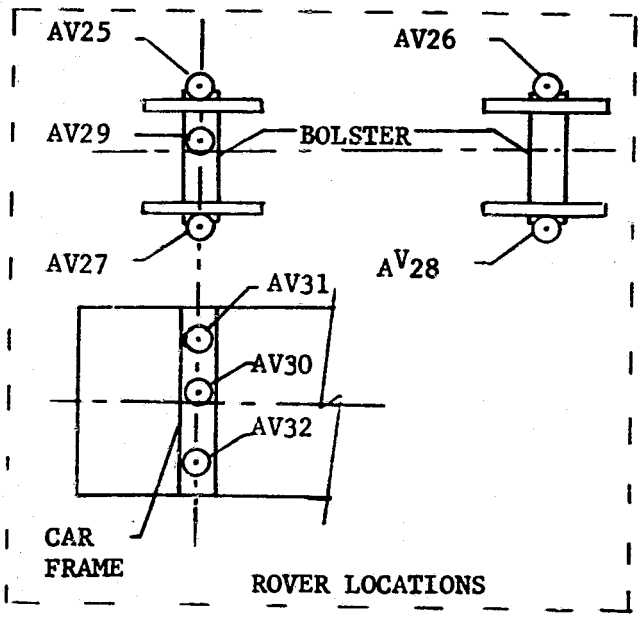
TRANSDUCER LOCATIONS

ACCELEROMETERS 50
(2) FORCE GAGES 8

NOTES:

(1) TRANSDUCERS NOT SHOWN IN ALL VIEWS

(2) ONLY SIX FORCE MEASUREMENTS WILL BE OBTAINED SIMULTANEOUSLY



R FIGURE 7.2 INSTRUMENTATION LOCATION AND MEASUREMENT NUMBERS

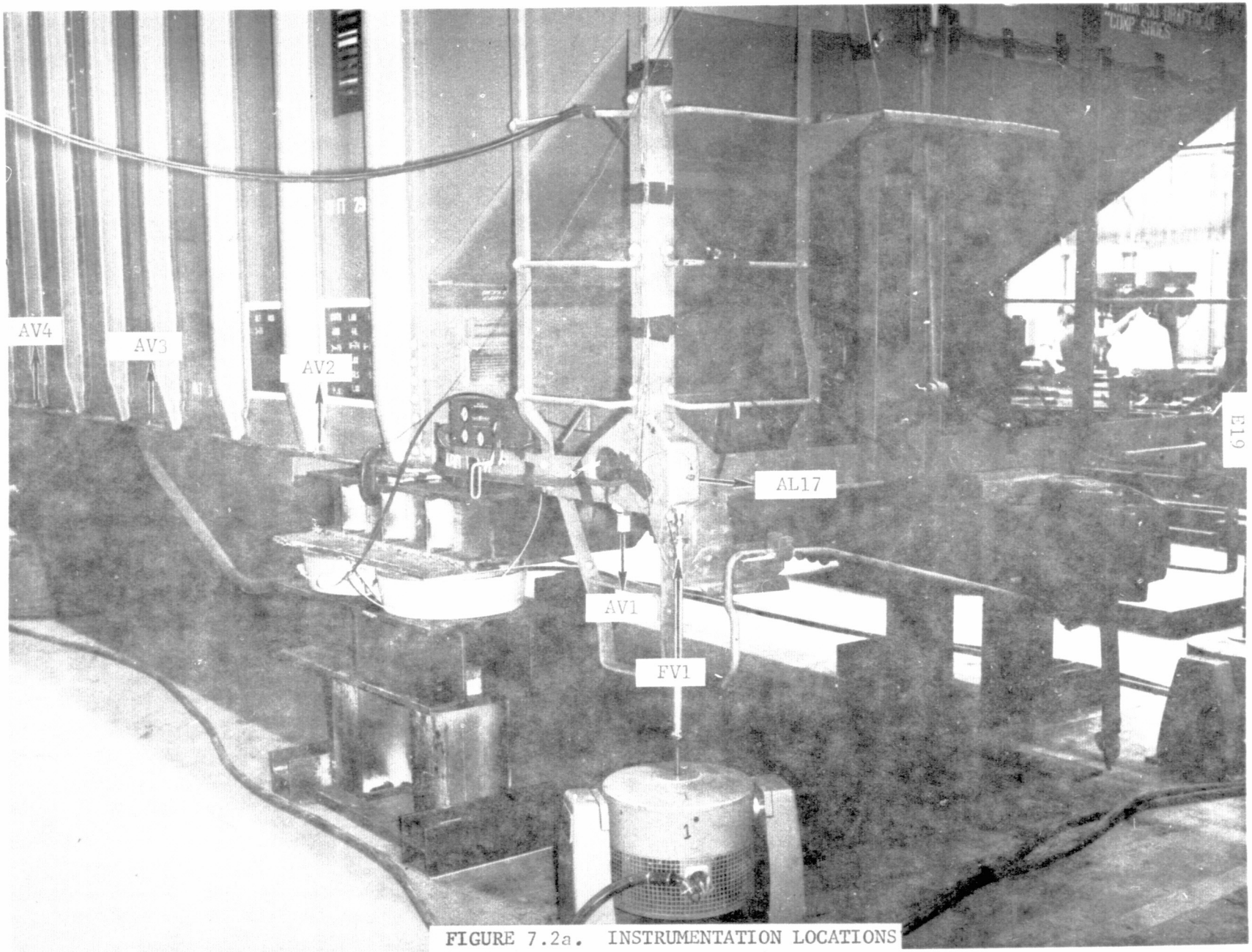


FIGURE 7.2a. INSTRUMENTATION LOCATIONS

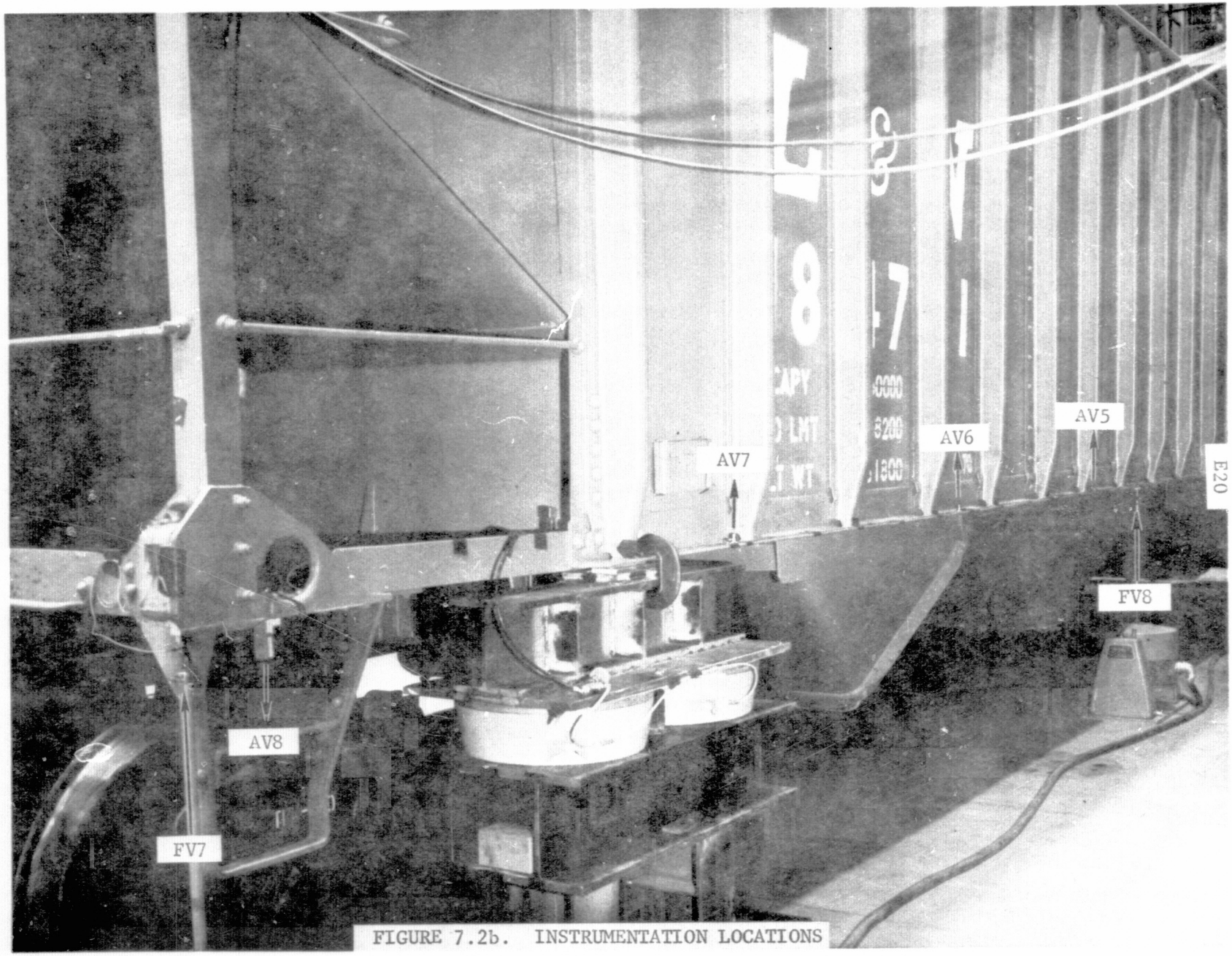


FIGURE 7.2b. INSTRUMENTATION LOCATIONS

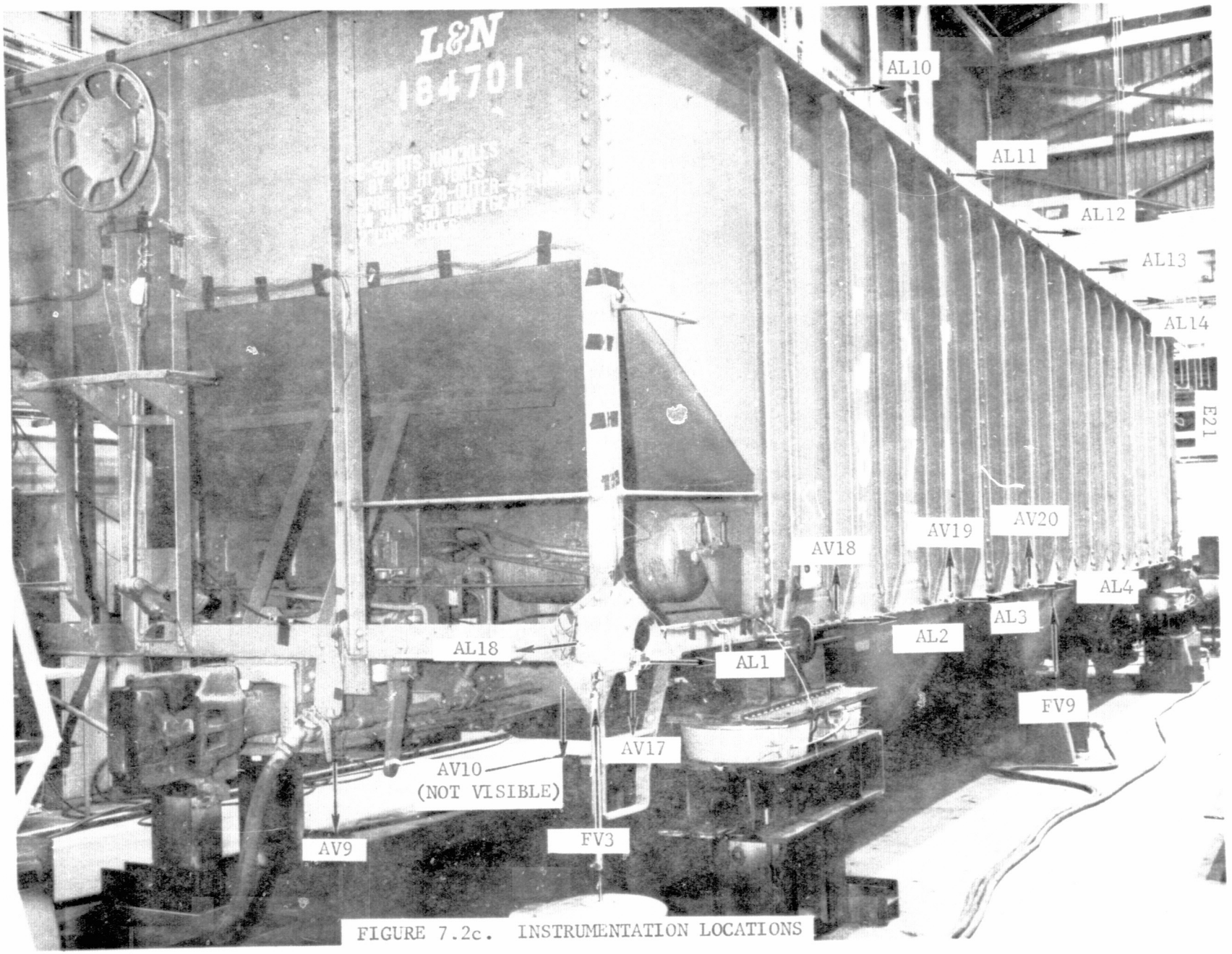


FIGURE 7.2c. INSTRUMENTATION LOCATIONS

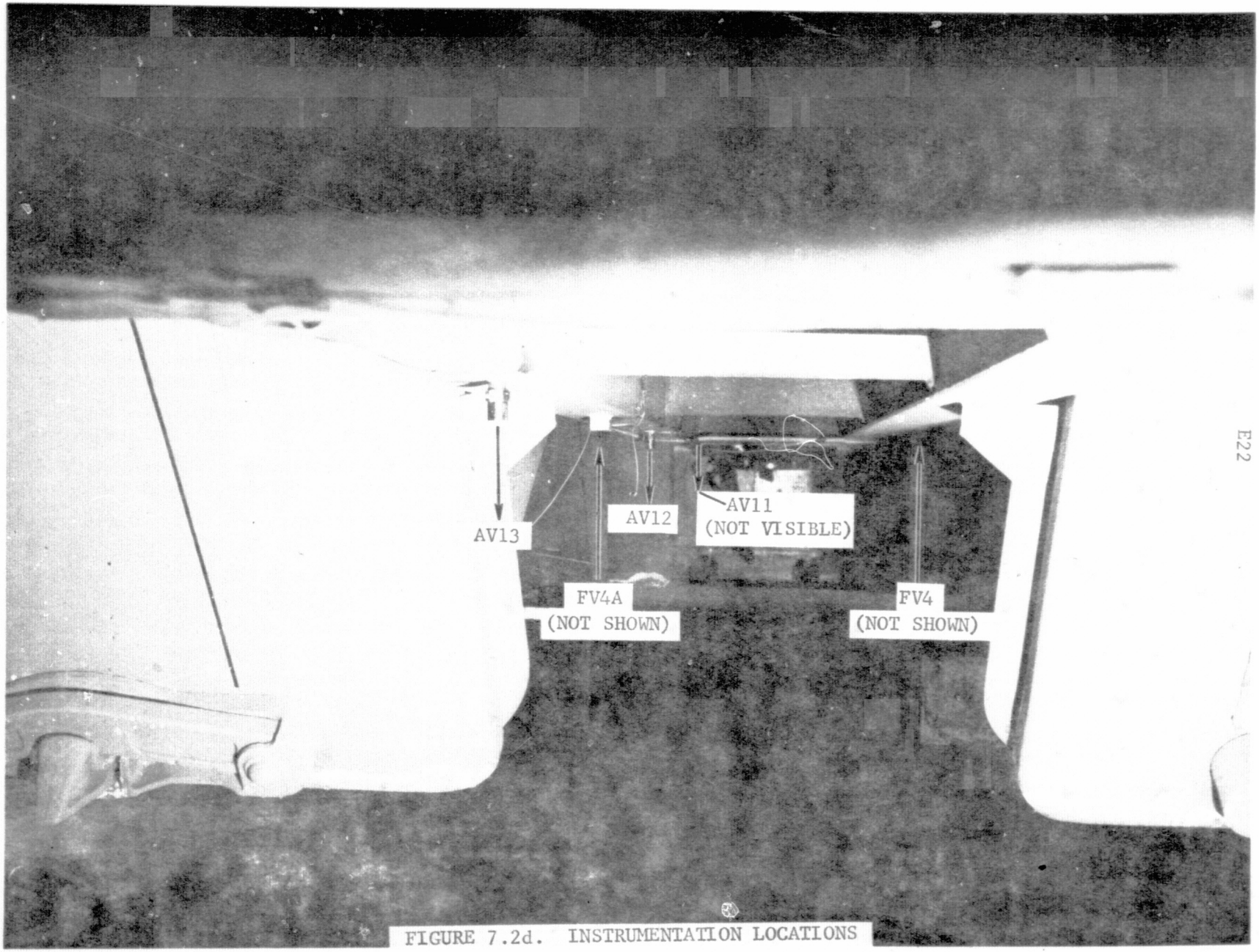


FIGURE 7.2d. INSTRUMENTATION LOCATIONS

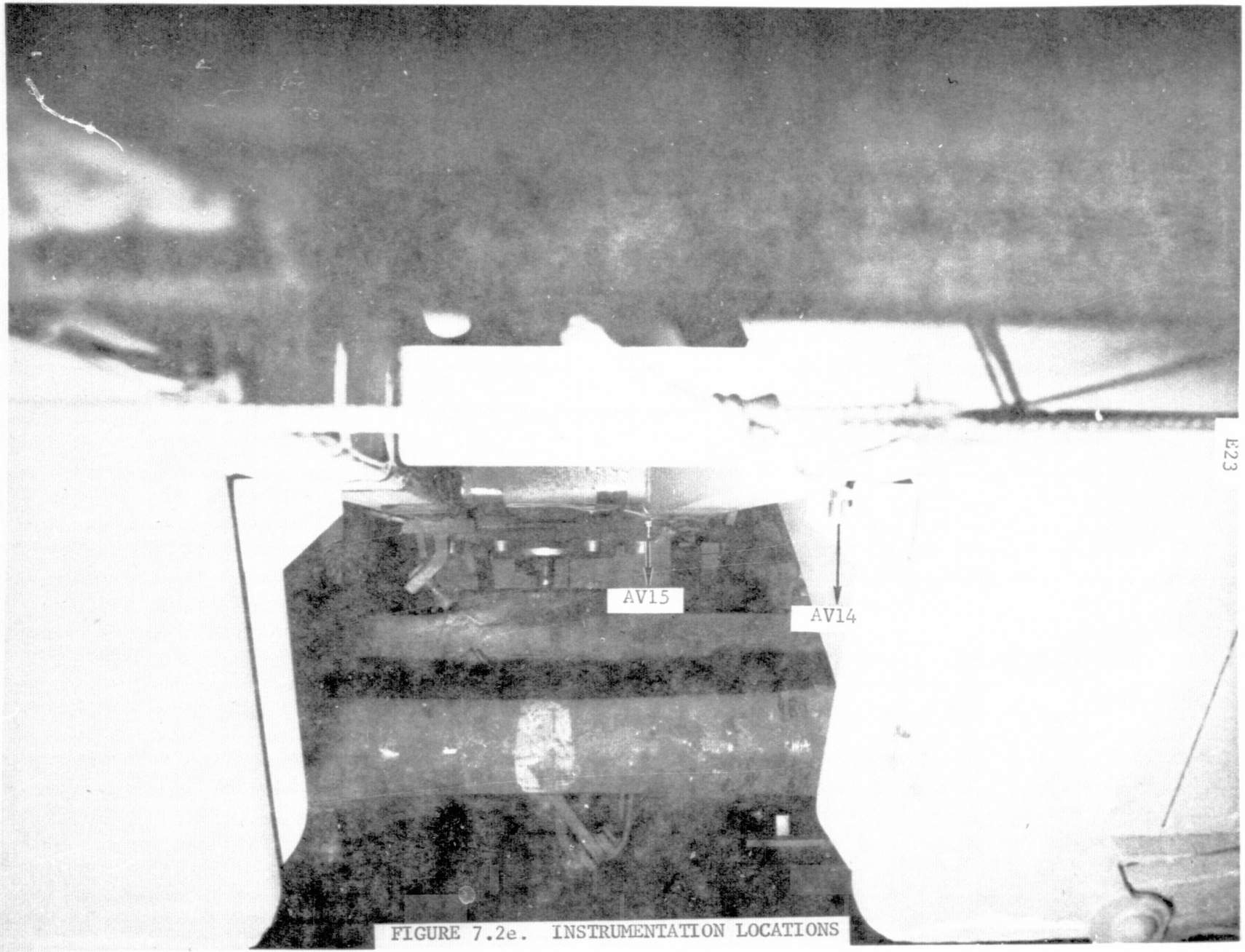


FIGURE 7.2e. INSTRUMENTATION LOCATIONS

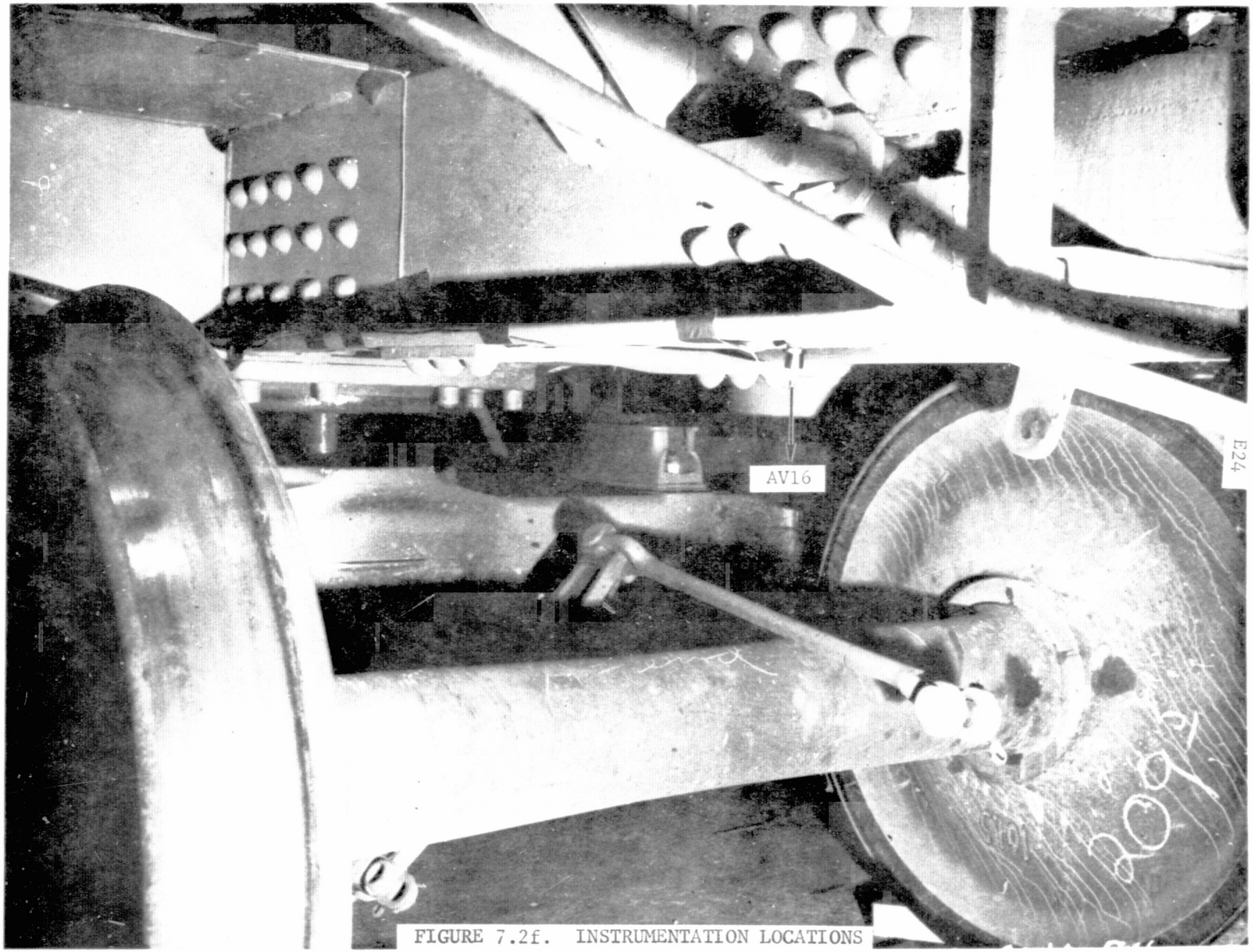


FIGURE 7.2f. INSTRUMENTATION LOCATIONS

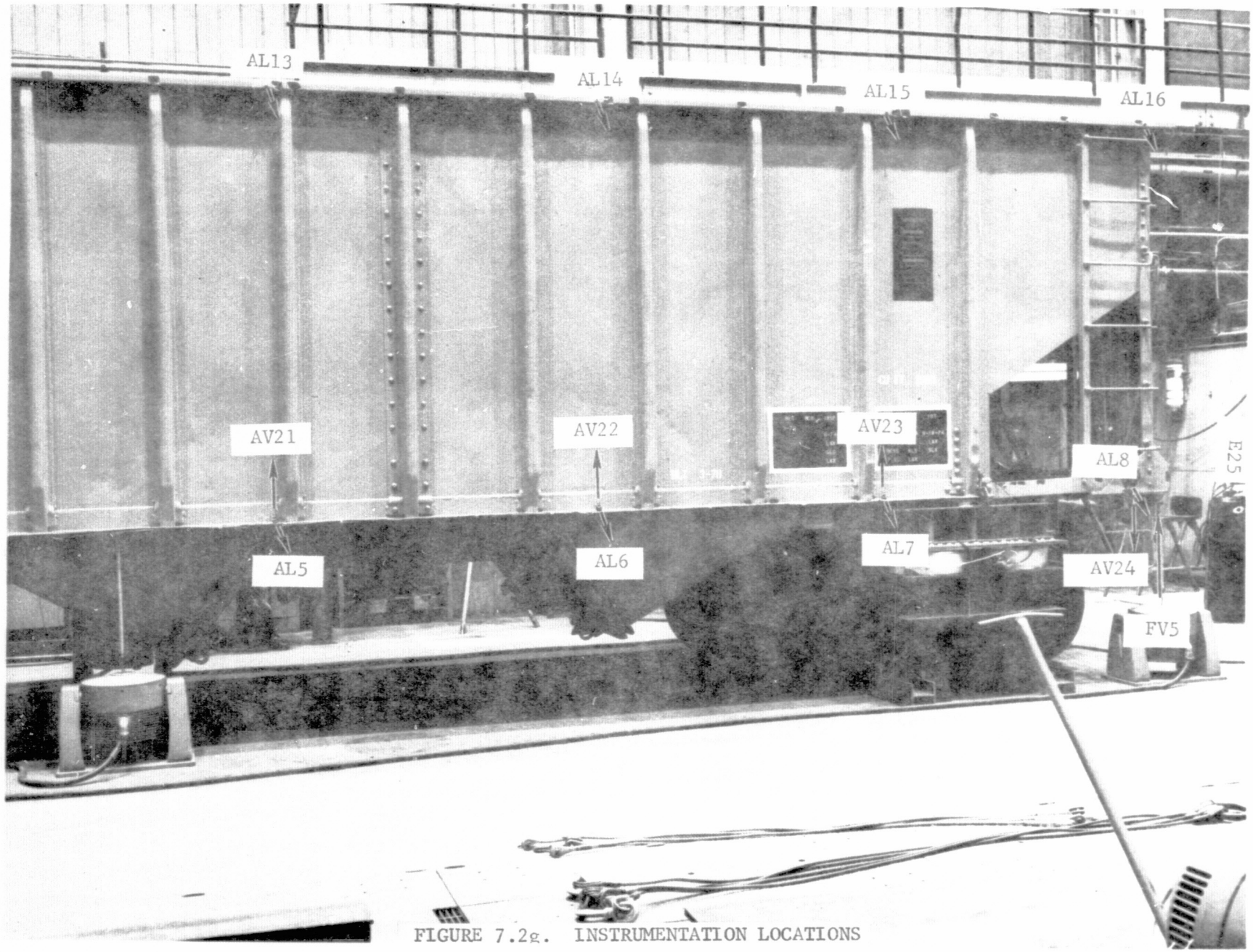


FIGURE 7.2g. INSTRUMENTATION LOCATIONS

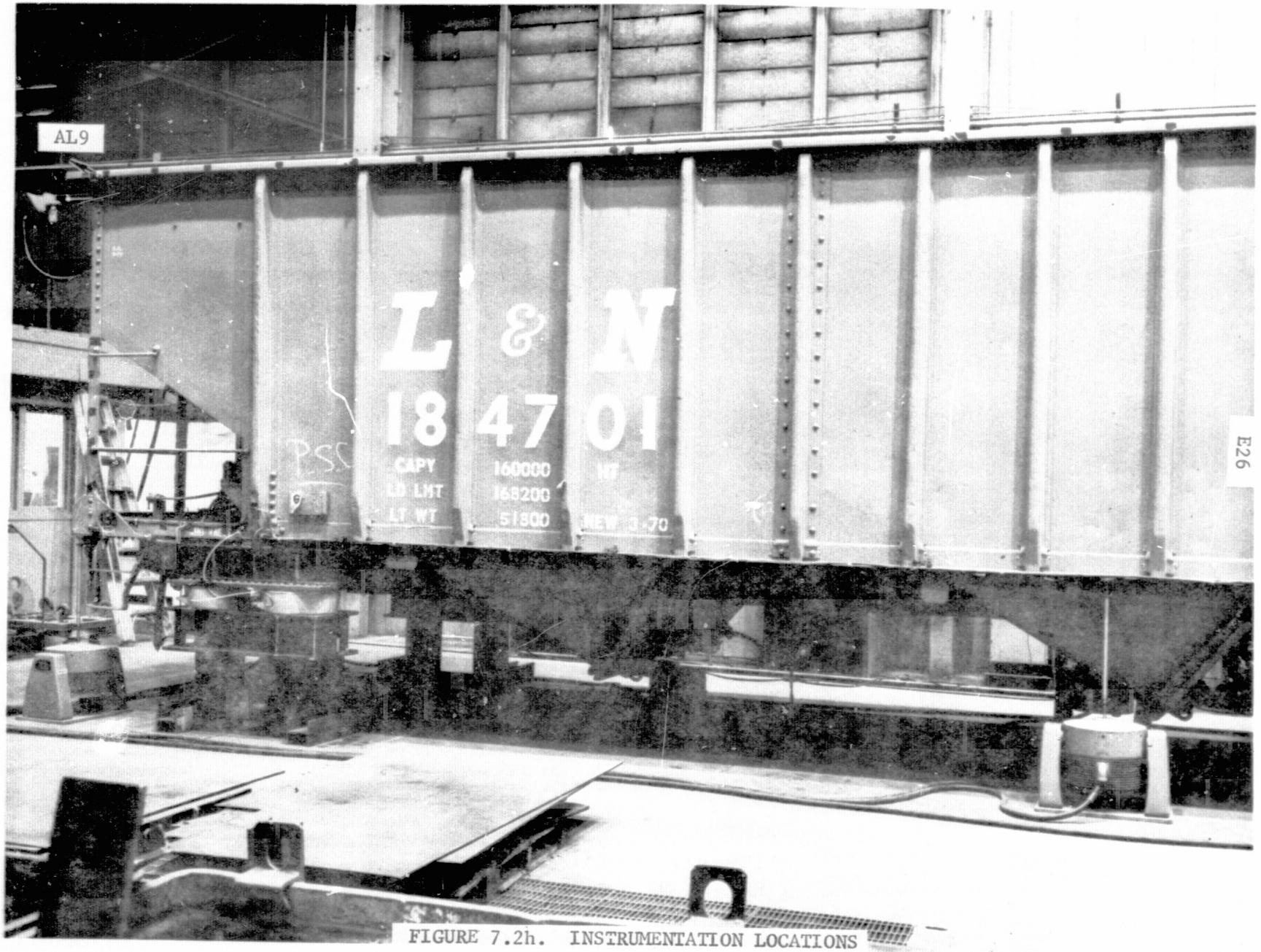
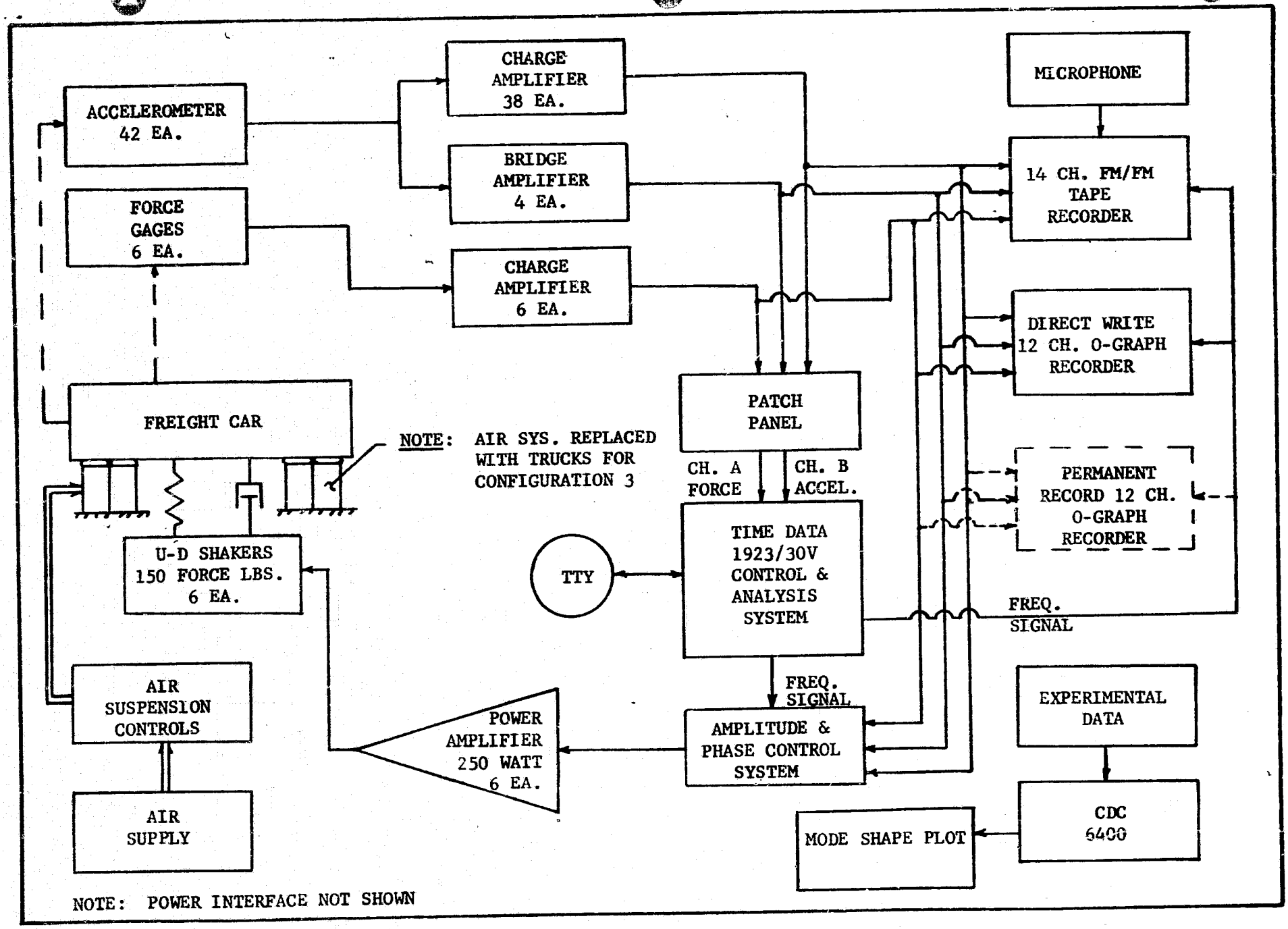


FIGURE 7.2h. INSTRUMENTATION LOCATIONS



R FIGURE 7.3 TEST INSTRUMENTATION & CONTROL SYSTEM BLOCK DIAGRAM

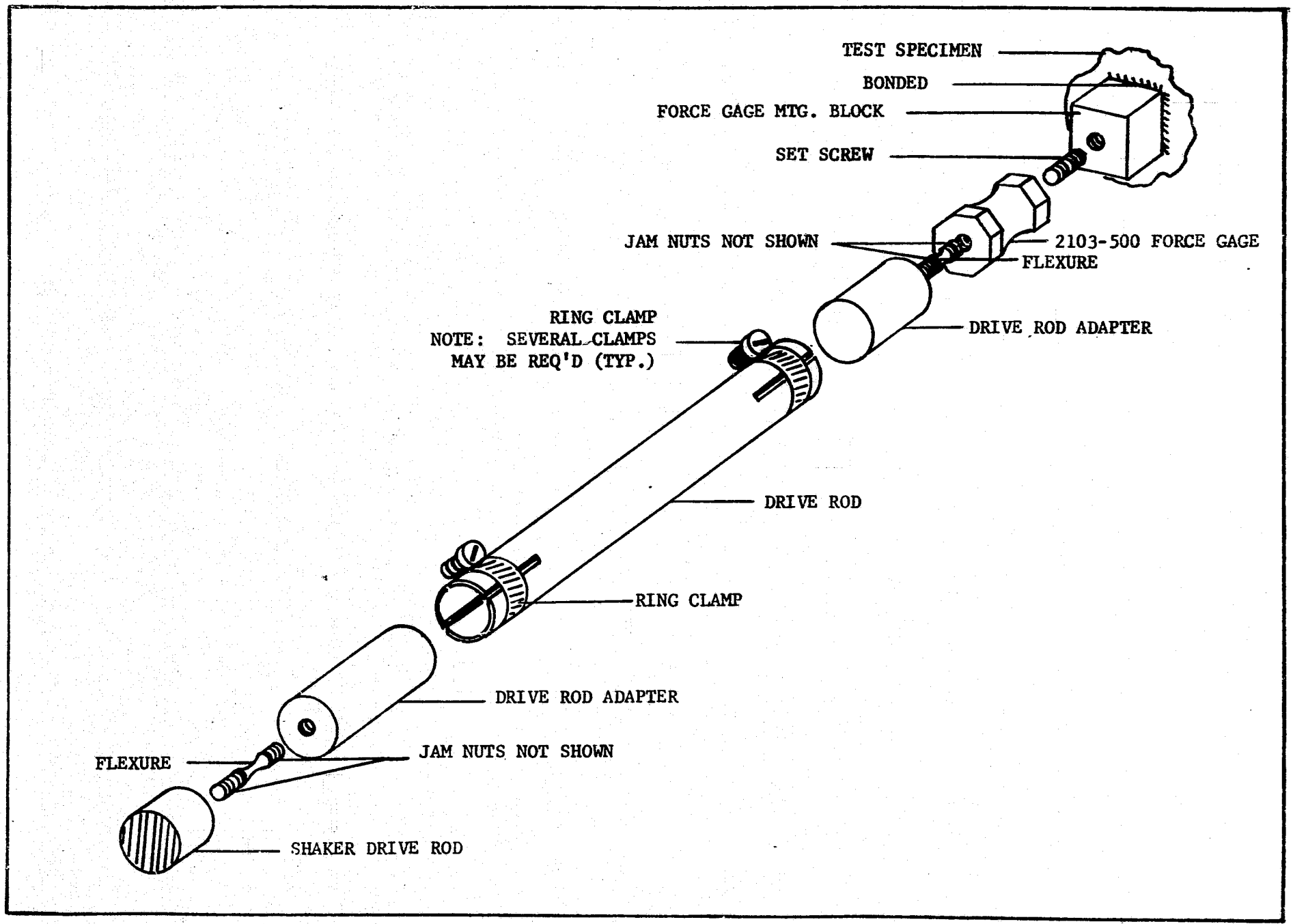
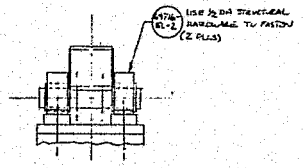


FIGURE 7.4 SHAKER STINGER ASSEMBLY

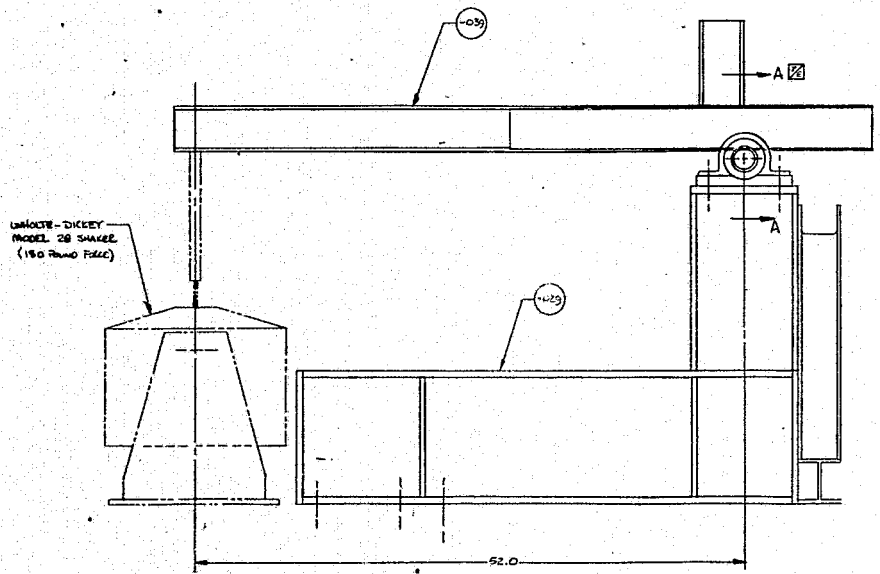
ORIGINAL PAGE IS
OF POOR QUALITY

NOTES:

1. BREAK ALL SHARP EDGES AND CORNERS.
2. ALL WELDS 1/8 INCH LEGS MINIMUM.



SECTION A-A



-049 ASSY 4 REQD

SCALE: 1/4

FIGURE 7.5. FORCE MULTIPLIER ASSEMBLY

E29
15M

047116-SL-2	TYP	1	PILLOW BLOCK	2 IN DIAMETER	BOTTOM MOUNT		
-048							
-047							
-046							
-045							
-044							
-043							
-042							
-041							
-040							
-007							
-006							
-005							
-004							
-003							
-002	GR	2	SUPPLY BEAM	W6X25		ASTM A-36 STEEL	
-001	TG	2	SPACER PLATE	12x6.5x1.15 PLATE		ASTM A-36 STEEL	
-038							
-039							
-040							
-041							
-042							
-043							
-044							
-045							
-046							
-047							
-048							
-049	AR	1	LOAD MULTIPLIER ASSY				
-050							
-051	TG	3	LOAD MULT PLATE-FULCRUM			ASTM A 36 STEEL	
-052	LF	3	FULCRUM SHAFT	2 IN DIAMETER		ASTM A36 STEEL	
-053	AR	3	LOAD MULTIPLIER BASE			ASTM A-36 STEEL	
-054	TG	2	ANGLE SUPPORT STAND			ASTM A-36 STEEL	
-055	TG	1	STAND LEG			ASTM A-36 STEEL	
-056	TG	2	BEAM ASSEMBLY	W10X77		ASTM A-36 STEEL	
-057	TG	2	AIR BAG-ONE 3/8 PLATE			ASTM A-36 STEEL	

2							
1							

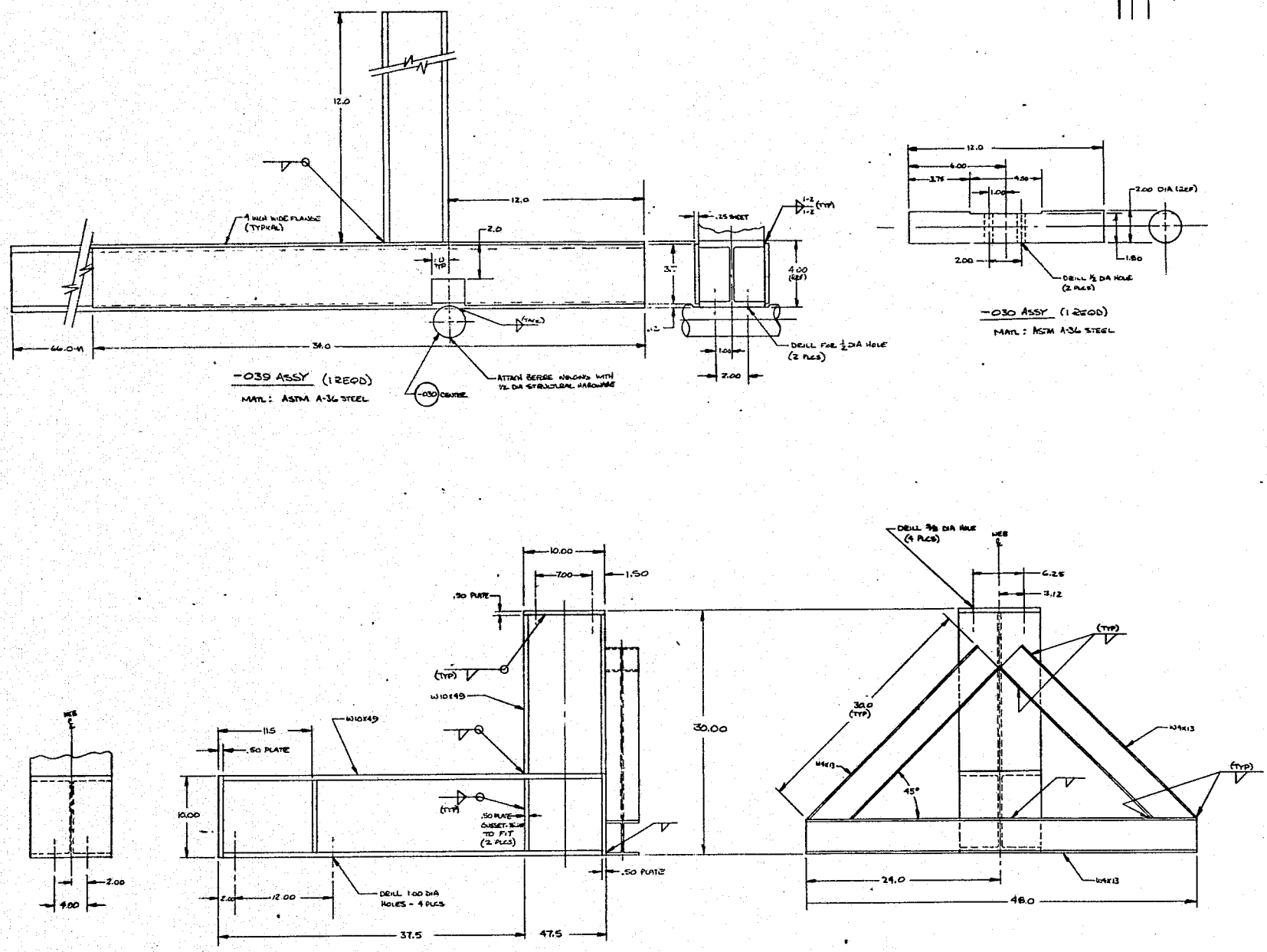
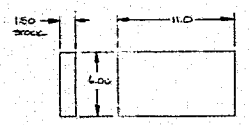


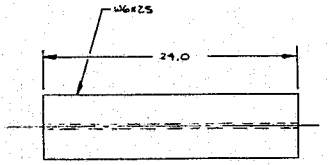
FIGURE 7.5. FORCE MULTIPLIER ASSEMBLY

LAB1007302



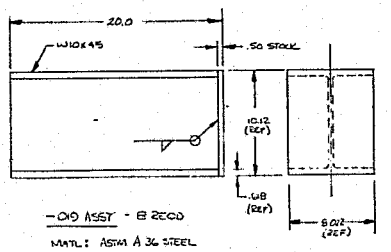
-001 DETAIL - 4 REQD

MATL: ASTM A 36 STEEL



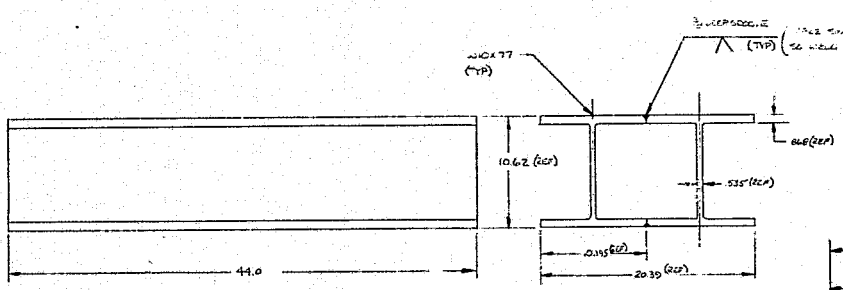
-002 DETAIL - 8 REQD

MATL: ASTM A 36 STEEL



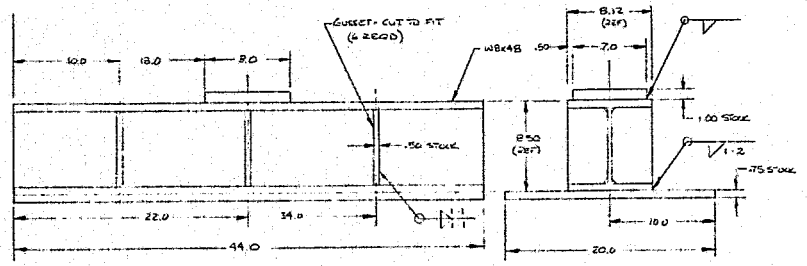
-019 ASST - 8 REQD

MATL: ASTM A 36 STEEL



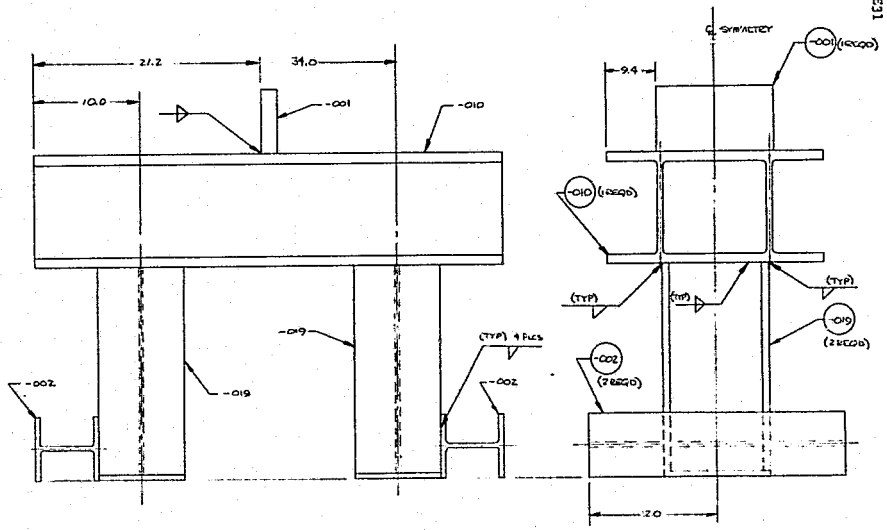
-010 ASST - (4 -REQ)

MATL: ASTM A 36 STEEL



-009 ASST - 4 REQD

MATL: ASTM A-36 STEEL



-020 ASST - 4 REQD

FIGURE 7.5. FORCE MULTIPLIER ASSEMBLY

15c. E31

LAB1007302

R TABLE 8.1 HANDLING EQUIPMENT

ITEM NO.	DESCRIPTION	MFG/MODEL NO.	QTY
1	Facility Crane (20,000 lb. Cap.)	P&H	1
2	Facility Handling Slings and Harnesses	MMC	As Req'd
3	Hydraulic Jacks	Hein Werner	2
4	Coal Conveyor System		1
5	Hauling Trucks		2

R TABLE 8.2 TEST EQUIPMENT

ITEM NO.	DESCRIPTION	MFG./MODEL NO.	QTY
1	Computer (Shaker Control & Data Analysis)	Time Data/1923 30V	1
2	Shaker Amplitude & Ø Control Console	MMC	1
3	Power Amplifier (250 Watt)	U-D/A250	6
4	Electro-Dynamic Shaker (150 lb-Force)	U-D/28	6
5	Shaker Support Assembly	MMC/LAB 1007302	6
6	Shaker Force Amplifier Assembly	MMC/LAB 1007302	6
7	Stinger/Flexure Assembly	MMC	6
8	Accelerometer Mounting Blocks	MMC	34
9	Accelerometer Isolation Studs	Endevco/	38
10	Force Gage Mounting Blocks	MMC	6
11	Accelerometer	Endevco/2213C	8
12	Accelerometer	Endevco/2215	3
13	Accelerometer	Endevco/2217	1
14	Accelerometer	Endevco/2272	16
15	Accelerometer	U-D/75 D 21	2
16	Accelerometer	Columbia/302-2	8
17	Accelerometer	Statham/A5a-2.0-350	4
		TOTAL	42
18	Force Gage	Endevco/2103-500	6
19	Charge Amplifier	Kistler/505M111	44
20	Bridge Amplifier	Dana/	4
21	Coax Switch	MMC	1
22	Tape Recorder (FM/FM)	Ampex/	1
23	Oscillograph Recorder (Direct Write)	Honeywell/	1
24	Oscillograph Recorder (Permanent Record)	CEC/	1
25	Cable (100 foot mini-noise)	Microdot/	44

R TABLE 8.2 TEST EQUIPMENT (Continued)

ITEM NO.	DESCRIPTION	MFG./MODEL NO.	QTY
26	Equipment Interconnecting & Power Cables		As Req'd
27	Air Suspension Support Assembly	MMC/LAB 1007302	4
28	Serva-Level Air Suspension System	Barry Controls	1 (8 pads)
29	Digital Voltmeter	John Fluke	1
30	VOM	Simpson/269	1

R

TABLE 8.3 INSTRUMENTATION SETUP SHEET

MEAS. NO.	XDUCR MODEL NO.	XDUCR SENS.	SIG. COND. CH. NO.	TAPE CH. NO.	TAPE FS CALIB.	O-GRAPH CH. NO.	O-GRAPH FS CALIB.	REMOTE CONSOLE CH. NO.	ACCEL. S/N	RUN NO.	DATE
AV1	A5a5.0	1 V/g	13 Dana Amp						7083		
AV2	2213	41.5 pCb/g	1 Ch Amp						GL23		
AV3	2213C	14.62	2						7696		
AV4	2213	16.0	3						2867		
AV5	2213	15.4	4						7688		
AV6	2213	14.66	5						3506		
AV7	2213	12.54 13.96	6						MA08 6653		
AV8	A5a2.0	1 V/g	15 Dana Amp						6467 6587		
AV9	302-2	62.0 pCb/g	7 Ch Amp						3136		
AV10	302-2	82.3	8						3251		
AV11	302-2	61.0	9						3139		
AV12	302-2	63.2	10						3135		
AV13	302-2	81.7	11						3249		
AV14	302-2	77.8	12						3248		
AV15	75D21	81.37	13						423		
AV16	75D21	79.38	14						421		
AV17	A5a2.0	1 V/g	14 Dana Amp						6579		
AV18	2213	14.53 pcb/g	15 Ch Amp						8600		
AV19	2215	42.3	16						4844		
AV20	2215	44.1	17						5956		
AV21	2215	45.1	18						5953		
AV22	2213	16.5	19						2880		
AV23	2217	31.8	20						DB10		
AV24	A5a2.0	1 V/g	16 Dana Amp						4703		

TABLE 8.3 INSTRUMENTATION SETUP SHEET

MEAS. NO.	XDUCR. MODEL NO.	XDUCR. SENS.	SIG. COND. CH. NO.	TAPE CH. NO.	TAPE FS CALIB.	O-GRAPH CH. NO.	O-GRAPH FS CALIB.	REMOTE CONSOLE CH. NO.	ACCEL. S/N	RUN NO.	DATE
		pcb/g	Ch Amp								
AL1	302-2	60.9	21						3137		
AL2	2272	12.03	22						MB58		
AL3	2272	13.0	23						MA17		
AL4	2272	12.4	24						MA01		
AL5	2272	12.6	25						MA07		
AL6	2272	13.1	26						MF83		
AL7	2272	12.3	27						MB53		
AL8	302-2	64.2	28						3138		
AL9	2272	12.57	29						NC67		
AL10	2272	12.47	30						WG90		
AL11	2272	11.77	31						MA09		
AL12	2272	12.5	32						MB57		
AL13	2272	12.28	33						VF70		
AL14	2272	13.0	34						VF84		
AL15	2272	12.49	35						MB55		
AL16	2272	12.15	36						VG01		
AL17	2272	12.7	37						UF96		
AL18	2272	12.4	38						MA18		

R

TABLE 8.3 INSTRUMENTATION SETUP SHEET

MEAS. NO.	XDUCR. MODEL NO.	XDUCR. SENS.	SIG. COND. CH. NO.	TAPE CH. NO.	TAPE FS CALIB.	O-GRAPH CH. NO.	O-GRAPH FS CALIB.	REMOTE CONSOLE CH. NO.	ACCEL. S/N	RUN NO.	DATE
FV1	2103-500	42.0 pcb/lb	39						RA14		
FV3		38.5	41						RA12		
FV4		36.0	42						RA13		
FV5		38.5	43						RA26		
FV7		43.5	44						RA30		
		36.0	42						RA13		
		43.0	40						RA27		
FV4A	2103-500	43.0	40						RA27		
OSC.	Rockland		1 V pk								
VOICE											

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
0900	10/17/74	1 WB	Force Multiplier Evaluation, Car Empty Wide Band Sweep from 0.5 to 50 Hz @ 0.2 Hz increments, CO/QUAD plot of AV17/F3, 20 lb-pk @ 10 Hz Ref. shaker driving through force multiplier. Synthesizer output set @ 1.0 V peak.	Started test 1923 would not increment frequency. Manual operation seems normal. Went into trouble shooting mode. Found patch error corrected and resumed test.
1345		1 WB	Repeat run 1 WB, and completed	Monitored AV17/F3
1410		2 WB	Completed 2 WB. repeat of 1 WB	Monitored AV20/F3
1426		3 WB	Completed 3 WB, repeat of 1 WB	Monitored AV21/F3
1438		4 WB	Completed 4 WB, repeat of 1 WB	Monitored AV24/F3
1520	10/17/74	1 R	Completed rerun of 1 WB	Verified accel. AV17/F3 operation and continued test.
0815	10/18/74	5 WB	Completed run 5 WB, repeat of 1 WB	Monitored AV18/F3
0855		6 WB	Completed run 6 WB, repeat of 1 WB except as noted. Response amplitudes low, removed tape from stinger and went to rigid link.	Monitored AV17/F3 100 lbs-pk input @ 10 Hz ref. shaker driving direct.
0914		6 WBR	Completed run 6 WBR, repeat of 6 WB	Monitored AV17/F3
0935		7 WB	Completed run 7 WB, repeat of 6 WB	Monitored AV20/F3
0950		8 WB	Completed run 8 WB, repeat of 6 WB, relocated AL1 to sense the same direction as AV17	Monitored AL1/F3
1010	10/18/74	9 WB	Completed run 9 WB, repeat of 6 WB. Response levels low, moved shaker V3 to outboard edge of car and removed shaker dolly, conducted accel. Tap check AL4, AL17, AV9, AV10, AV12 bad (AL12 cleaned cable)	Monitored AV21/F3 Replaced cable on AV12 Set range on AL4 Replaced ch. amp. AL17 AV9 and 10 OK

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1325	10/18/74	10 WB	Force Multiplier Evaluation, Car Empty Completed run 10 WB, repeat of 6 WB except new shaker location.	Monitored AV17/F3
1337		11 WB	Completed run 11 WB, repeat of 10 WB.	Monitored AV20/F3
1358		12 WB	Completed run 12 WB, repeat of 10 WB except ref. force set @ 20 Hz 150 lbs-peak. Add shaker V7, excited system with local osc. Observed modes @ ≈6 Hz, 17 Hz & 18.5 Hz.	Monitored AV20/F3
1530			Stopped testing.	
0800	10/21/74		Substituted force multiplier @ V3 location, moved AL18 to shaker end of multiplier, and AL1 to input end of multiplier.	
0935		13 WB	Completed run 13 WB, repeat of 1 WB.	Monitored AV17/F3
0955		14 WB	Completed run 14 WB, repeat of 1 WB.	Monitored AL24/F3
1025		15 WB	Completed run 15 WB, repeat of 1 WB.	Monitored AL18/F3
1039		16 WB	Completed run 16 WB, repeat of 1 WB.	Monitored AL1/F3

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
	10/21/74		Track-Train GVS, Car Empty Connected shakers V1, V3, V5 and V7 Sweep Frequency: 0.5 to 10 Hz Force Ref: ≈40 lbs-pk @ 10 Hz on all shakers (280 mvrms) Shaker Phase: $180^{\circ}V_1$, $0^{\circ}V_3$, $180^{\circ}V_5$ and $0^{\circ}V_7$	Monitored AV17/F3 F3 280 mvrms 7.07 mvrms/lb-pk
1320		1 NB	Completed run 1 NB (AV17/F3)	
1330		Decay 1	Tuned 6.35 1st torsional mode and took decays on AV1, AV8, AV17 and AV24 real time	Decays look good Slight wave form distortion but no beating apparent
1527		Dwell 1 Mode 1	Retuned 1st torsional mode @ 6.75 Hz with ≈80 lbs-pk force per shaker (560 mvrms). Was in the process of taking CO/QUAD data when power went out on computer. Reloaded program and continued. Completed CO/QUAD tabulations for 6.75 Hz mode.	
0755	10/22/74	Verification	Verified 6.75 Hz frequency from previous day by checking QUAD peak AV17/F3	
0907		Dwell 1 Mode 1 Repeat	Repeated dwell 1/mode 1 tabulations, found error in gain settings from previous day of AV1, AV8, AV17 and AV24. Other data had good repeatability.	* Verified AV8 reads low
End Shift	10/22/74	Decay 2	Set up and repaired tape deck, lost pwr on 1923, reloaded program, switched power to unload 1923 circuit. Replaced charge amp on AV14 CO/QUAD data reading for 6.75 Hz mode was high.	
0730	10/23/74		Replaced AV8 with 5g strain gage accel. Checked noise on all accel./force channels. AL1/charge amp. 21 has slight amount of noise (.024V or .025g).	

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
			Track-Train GVS, Car Empty Observed same Ø shift on AV8 as previously indicated with 2g accel. Verified Ø of instrumentation found Ø shift in Dana amp. which was used for meas. AV8. Replaced Dana amplifier and verified Ø.	
1000	10/23/74	Repeat Model Dwell 1	Completed repeat of mode 1, dwell 1	Ref. force F3 560 mvrms @ 6.75 Hz 707 mvrms/100 lbs-pk
1010		Decay 2	Raised gains on AV1, AV8, AV17 and AV24 by a factor of 10 (10v/g). Recorded two decays on tape for the 6.75 Hz mode. Returned gains back to times 1 (1 v/g).	
1052		2 NB	Shakers: V1, V3, V5 and V7 Sweep Freq: 0.5 to 5 Hz Force Ref: ≈80 lbs-pk/shaker Shaker Ø: V1 and V7=0°Ø, V3 and V5=180°Ø Completed run 2 NB (AV1/F3)	Monitored AV1/F3 Ref. force F3 560 mvrms @ 5 Hz 7.07 mvrms/1b-pk
1214	10/23/74	3 NB	Completed run 3 NB, repeat of 2 NB except as noted *.	*Monitored AV8/F3 2nd mode 3.5 Hz
1230		4 NB	Completed run 4 NB, repeat of 2 NB except as noted *.	*Monitored AV17/F3
1240		5 NB	Completed run 5 NB, repeat of 2 NB except as noted *.	*Monitored AV24/F3
		Mode 2 Dwell 2	Tuned 2nd mode 1st torsional suspension mode @ 3.45 Hz. Obtained CO/QUAD values for AV1, AV8, AV17 and AV24 plus forces	Ref. force F1, set @ 450 mvrms 7.07 mvrms/1b-pk
1315		17WB	Shakers: V1,V3,V4,V5,V7 ; Sweep Freq.: 10-50Hz; Force Ref.: ≈80 lbs-pk On V4 (560mvrms@ 20Hz) ≈20 lbs-pk On All Other Shakers(141mvrms) Shaker Ø: V1,V3,V5,V6=0° Ø ; V4=180° Ø	Monitored AV12/F4 7.07mvrms/1b-pk
1324		18WB	Completed Run 18WB,Repeat Of 17WB Except AS Noted *	* Monitored AV9/F4
1335		19WB	Completed Run 19WB,Repeat Of 17WB Except As Noted*	* Monitored AV16/F4

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1355	10/23/74	20 WB	Track-Train GVS, Car Empty Completed run 20 WB, repeat of 17 WB except as noted *. Moved freight car couplers to one side and detuned mode.	*Monitored AL12/F4
1415		21 WB	Completed run 21 WB, repeat of 17 WB. Spiked couplers with wood wedges to reduce their motion.	Monitored AV12/F4
1428		22 WB	Wedges added. Completed run 22 WB, repeat of 17 WB. Added wedge to center brake rod.	Monitored AV12/F4
1455		23 WB	Completed run 23 WB, repeat of 17 WB	Monitored AV12/F4
1517		24 WB	Completed run 24 WB, repeat of 17 WB, except as noted *.	*Monitored AL12/F4
0810	10/24/74	25 WB	Tied off center brake rod in two places In the center of the car Completed run 25 WB, repeat of 17 WB.	Monitored AV12/F4
0830		26 WB	Secured ropes holding center brake rod. Completed run 26 WB, repeat of 17 WB.	Monitored AV12/F4
0840		Mode 3 Dwell 3	Tuned mode 3 1st vertical bending @ 29.65 Hz.	Force ref. F4 560 mvrms 7.07 mvrms/lb-pk
0903		Decay 3	Recorded decays on AV9, 12, 13 and 16 real time @ 29.65 Hz. Noticed slight beat in decay. Returned by peaking quadrature @ 29.53 Hz and took decays noticed slight mode drift returned @ 29.57 Hz.	
0928		Mode 3 Dwell 3	Took CO/QUAD tabulations of mode 3 @ 29.57 Hz	Force ref. F4 @ 560 mvrms.
1002		Decay 4	Recorded on mag. tape, mode 3 decays, meas. AV9, 12, 13 and 16, F4 and OSC. Raised gains by a factor of 10 times on accel. ch.	Recorded Three Decays 1st Decay Void . 29.57 Hz

TABLE 8.4 TEST HISTORICAL LOG

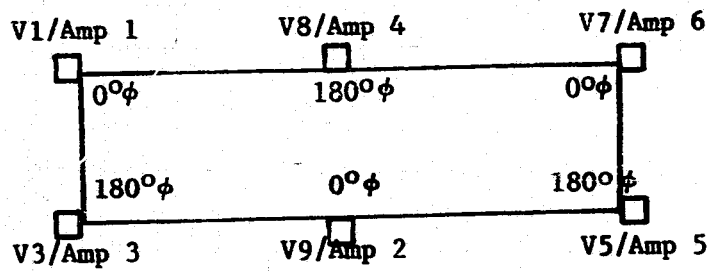
TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
	10/24/74		<u>Track-Train GVS, Car Empty</u> Repaired fan cable on shaker V3 Moved shakers V2 and V4 to middle outboard sides of car shaker configuration as follows:  Shakers: V1, V3, V5, V7, V8 and V9 Sweep Freq: 10-50 Hz Force Ref: ≈ 40 lbs-pk on V8 and V9 (282 mvrms) ≈ 20 lbs-pk on all others (141 mvrms)	
1315		27 WB	Shaker Ø: V1, V7 and V9=0° ϕ V3, V5 and V8=180° ϕ Completed run 27 WB	Force ref. F4 set @ 10 Hz 282 mvrms, 7.07 mvrms/lb-pk Monitored AV1/F4,V9 shaker fan not working, open motor circuit, used external fan.
1345		Decay 5	Recorded decay @ ≈ 17 Hz, remote osc., on AV1, 8, 17 and 24, also AL12	
1422		Mode 4 Dwell 4	Tuned mode 4 2nd torsional by peaking quadrature AV1/F4 @ 17.64 Hz. Took CO/QUAD tabulations of mode 4 @ 17.64 Hz	Force ref. F8 280 mvrms 7.07 mvrms/lb-pk
1448		Decay 6	Recorded decay 6 on mag. tape, 2 decays, meas. AV1, 8, 17, 24, AL12, F8 and osc. Raised gains on accels. by a factor of 10 times. S.G. accels. only.	17.64 Hz

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
	10/25/74 ↓		<u>Track-Train GVS, Car Empty</u> Recorded decays for modes 1, 3 and 4 on permanent records. Repaired fan on shaker V9. Took photographs of inst. and shaker locations and overall setup. Installed height sensor in 4th air bag setup. Installed flexures on shakers V8 and V9 stinger assemblies.	

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
0910	11/4/74		<u>Track-Train GVS - Car Full</u> Car raised on air suspension system	Used GN_2 supply.
1005		6 NB	Connected shakers V1, V3, V5 and V7 Freq. Sweep: 0.5 Hz to 15 Hz, .2 Hz increment Force Ref: ≈ 100 lbs-pk @ 10 Hz all shakers Shaker Ø: V1 and V5=0°ϕ, V3 and V7=180°ϕ Completed run 6 NB (AV17/F3)	Monitored AV17/F3 F3 707 mvrms Approx. 100 lb-pk (7.07 mvrms/lb-pk)
1055		Mode 1 Dwell 1	Tuned mode 1, 1st torsional mode @ 6.75 Hz. Found bad accel. channel AL12. adjusted noise, cleaned microdot connector and continued taking mode.	
1355		28 WB 29 WB Repeat of 28 WB	Shakers V1, V3, V5, V7, V8 and V9 Freq. Sweep: 5 Hz-50 Hz Shaker Ø: V1, V9 and V7=0°ϕ, V3, V5 and V8=180°ϕ Force ref. V8 @ ≈100 lb-pk all other @ ≈100 lb-pk Completed run 28 WB	Monitored AV1/F8 V3 flexure broke Replaced & Repeated Sweep
1410		30 WB	Shakers V1, V3, V5, V7, V8 and V9 Freq. Sweep: 5-50 Hz Shaker Ø: V1, V3, V5 and V7=0°ϕ V8 and V9=180°ϕ Force Ref: ≈100 lb-pk all shakers Completed run 30 WB	Monitored AV12/F8
	11/5/74		Installed force multiplier's at shaker positions V3 and V7 and checked operation, shimmed multiplier center base area.	
	11/6/74		Installed force multiplier's at shaker positions V1 and V5, photographed control room, checked out inst. noise levels, operation, etc. Replace charge amp. on AL12.	
1030	11/7/74		Tuned 1st torsional mode @ 7 Hz Shakers: V1, V3, V5 and V7 Shaker Ø: V1 and V5=0°ϕ V3 and V7=180°ϕ	Monitored AV17/F3 Shaker V7 car stinger attachment broke

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
	11/7/74		Track-Train GVS - Car Full	
		7 NB	Shakers: V1, V5=0°ϕ, V3 and V7=180°ϕ Freq: 2-10 Hz Shaker Force Ref: ≈ 30 lb-pk (200 mvrms @ 10 Hz)	Monitored AV17/F3
1225			Completed run 7 NB	
1305		Mode 1 Dwell 1	Tuned 1st torsional mode @ 6.3 Hz	Monitored AV17/F3 Force ref. F3 @ ≈10 lbs 73 mvrms
		8 NB	Shakers: V1, V7=0°ϕ, V3, V5=180°ϕ Freq: 1-10 Hz Shaker Force Ref: ≈ 30 lb-pk (200 mvrms @ 10 Hz)	Monitored AV1/F3
1325			Completed run 8 NB	
1335		9 NB	Completed run 9 NB	Monitored AV8/F3
1340		10 NB	Completed run 10 NB	Monitored AV17/F3
1345		11 NB	Completed run 11 NB	Monitored AV24/F3
1405	11/7/74	Mode 2 Dwell 2	Tuned 1st rigid body torsional @ 3.3 Hz. Took CO/QUAD data on AV1, AV8, AV17 and AV24, F1 and F5, F7 Force Ref: F3 110 mvrms≈15.5 lb-pk	Monitored AV17/F3
		12 NB	Shakers: V1, V9, V7=0°ϕ, V3, V8, V5=180°ϕ Freq: 5-20 Hz Force Ref: ≈ 30 lbs-pk all shakers 200 mvrms @ 10 Hz	Monitored AV1/F8
1445			Completed run 12 NB	
1500		Mode 3 Dwell 3	Tuned 2nd torsional mode @ 8.6 Hz	Monitored AV1/F8
1507		13 NB	Completed 13 NB, repeat of 12 NB except as noted *.	*Monitored AL1/F8
1515		Mode 3 Dwell 3	Tuned 2nd torsional mode @ 8.85 Hz	Monitored AL1/F8

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
0900	11/8/74	Mode 3 Dwell 3	<u>Track-Train GVS, Car Full</u> Took data on 2nd torsional mode. 8.85 Hz, tuned mode on AL1/F8, completed mode 3, replaced AL12 BNC to microdot, noisey channel, replaced microdot cable on AL18 Completed mode 3 Repaired brake on tape deck in prep. for decays	Monitored AL1/F8 Force ref. F8 ≈30 lb-pk 210 mvrms
1220	11/8/74	Decay 7 8	Took Decay 7,8,8.85 Hz, recorded on magnetic tape AL1, AV1, AV8, AV17, AV24, F8 and OSC. Shakers: V1, V9, V7=0° Ø, V3, V8, V5=180° Ø Force Ref. F8 210 mvrms ≈ 30 lbs, pk Completed decay 7	Recorded 2 decays Monitored AL1/F8
1230		Decay 9 10	Took decay 9,10, 3.3 Hz, recorded on mag. tape, AL1, AV1, AV8, AV17, AV24, F3 and OSC. Shakers: V1, V7=0° Ø, V3, V5=180° Ø Force Ref: F3 110 mvrms ≈ 15.5 lb-pk Completed decay 8	Recorded 2 decays Monitored AV17/F3
1237		Decay 11 12	Took decay 11, 12 6.3 Hz, recorded on mag. tape, AL1, AV1, AV8, AV17, AV24, F3 and OSC. Shakers: V1, V5=0° Ø, V3, V7=180° Ø Force Ref: F3 74 mvrms ≈ 10 lb-pk Completed decay 9	Recorded 2 decays Monitored AV17/F3 Returned gains on accels. to 1 Gp range
1330		31 WB	Shakers V1=0° Ø, V3=180° Ø, V7=0° Ø, V5= 180° Ø Freq: 1-50 Hz Force Ref: 200 mvrms @ 10 Hz ≈ 30 lb-pk	Monitored AV17/F3
1435		Dwell 4 Mode 4	Tuned 4 mode @ 13.6 Hz and took data, looked @ decays on scope (no beating), shakers V1, V7=0° Ø, V3, V5=180° Ø Force Ref: F3 78 mvrms ≈ 11 lbs-pk	Monitored AV17/F3
	11/8/74	Decay 13 14	Took decay 13 and 14@13.6 Hz, recorded on mag. tape. AL1, AV1, AV8, AV17, AV24, F3 and OSC. Shakers: V1, V7=0° Ø, V3, V5=180° Ø	Recorded 2 decays

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1440	11/8/74	Decay 13 14	Track-Train GVS, Car Full Force Ref: F3 78 mvrms ≈ 11 lb-pk Completed decay 13, 14	
1530			Moved shakers V8 and V9 to car center beam	
0955	11/11/74	32 WB	Shakers: V1, V3, V5 and V7=0° ∅ Freq: 1-50 Hz Force Ref: F3 200 mvrms @ 10 Hz ≈ 30 lb-pk Lost air shakers stopped a ≈ 35 Hz Reset air and continued Completed run 32 WB	Monitored AV12/F3 Movies were taken
1030		14 NB	Tuned 1st vert. rigid body suspension mode @ 2 Hz and conducted sweep. Completed run 14 NB setup same as 32 WB	Monitored AV17/F3
1040		15 NB	Completed run 15 NB, repeat of 14 NB except as noted *.	*Monitored AV1/F3
1045		16 NB	Completed run 16 NB, repeat of 14 NB except as noted *.	*Monitored AV8/F3
1050		17 NB	Completed run 17 NB, repeat of 14 NB except as noted *.	*Monitored AV24/F3
1056		18 NB	Completed run 18 NB, repeat of 14 NB except as noted *.	*Monitored AV12/F3
1230	11/11/74	Dwell 5 Mode 5	Tuned 1st vert. rigid body mode @ 2.15 Hz. Based on NB Sweeps 14-17 CO values. Took CO/QUAD data on AV1, 8, 12, 17 and 24 Completed test.	Monitored AV12/F3 Force ref. F3 = 100 mvrms

TABLE 8.4 TEST HISTORICAL LOG

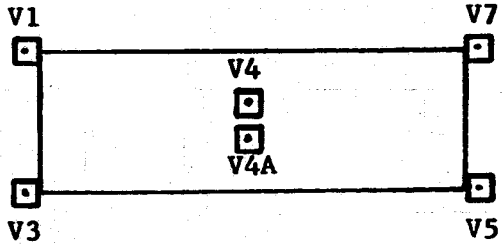
TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1310	11/11/74	19 NB	**Track-Train GVS, Car Full** Shakers V1, V3, V5 and V7 = 0° ∅, V4 and V4A = 180° ∅ Freq: 5-20 Hz Force ref. F4 707 mvrms @ 10 Hz = 100 lb-pk Completed 19 NB  Force Distribution: V1, 3, 5, 7 ≈ 30 lb-pk V4, V4A ≈ 100 lb-pk	Monitored AV12/F4
1513		Dwell 6 Mode 6	Tuned 1st vert. bending @ 11.9 Hz Force Ref: F4 707 mvrms = 100 lb-pk Tuned 1st vertical bending @ 12.3 Hz Force Ref: F4 350 mvrms ≈ 50 lb-pk Completed dwell 6, mode 6	Monitored MV12/F4 Took F4 = 100 lbs and 50 lbs Took mode @ 12.4 Hz also
0915	11/12/74	Dwell 7 Mode 7	Tuned 1st vert. bending @ 14.55 Hz Force ref: F4 707 mvrms = 100 lb-pk @ 10 Hz Force Ref: F4 350 mvrms ≈ 50 lb-pk @ 10 Hz Returned 14.75 Hz Completed dwell/mode 7	Monitored AV12/F4 Took F4 = 100 lbs and 50
0935		33 WB	Shakers V1, V3, V5 and V7 = 0° ∅ Force Ref: F3 350 mvrms ≈ 50 lb-pk @ 10 Hz Freq: 5-50 Hz, completed 33 WB	Monitored AV9/F3
1037		34 WB	Shakers V1, V3 = 0° ∅, V5, V7 = 180° ∅ Force Ref: F3 440 mvrms≈62 lb-pk @ 10 Hz Freq: 5-50 Hz Completed run 34 WB	Monitored AV9/F3

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1214	11/12/74	Mode 8 Dwell 8	<u>Track-Train GVS, Car Full</u> Tuned 2nd vertical bending mode @ 20.2 Hz Force Ref: F3 67.0 mvrms ≈ 10 lb-pk @ 20 Hz Shakers V1, V3 = 0° ∅, V5, V7 = 180° ∅ Completed mode 8, dwell 8	Monitored AV9/F3
1240		Mode 9 Dwell 9	Tuned 2nd vertical bending mode @ 17.1 Hz Force Ref: F3 88 mvrms ≈ 12 lb-pk @ Hz Shakers: V1, V3 = 0° ∅, V5, V7 = 180° ∅ Completed mode/dwell 9	Monitored AV9/F3
1406		Decay 15/16	Recorded decays on mag . tape Completed decay 15/16. recorded AV1, 8, 9, 12, 17, 24, F3 and OSC.	Freq. 17.1 Hz
1417		Decay 17/18	Completed decay 17/18, repeat of 15/16 except freq. & Force Distribution	Freq. 20.2 Hz
1425		Decay 19/20	Completed decay 19/20, repeat of 15/16 except freq.& Force Dist.	Freq. 2.15 Hz
1437		Decay 21/22 23/24	Completed decay 21/22, repeat of 15/16 except freq.& Force Dist. Completed decay 23/24	Freq. 14.75 Hz Freq. 14.55 Hz
1455		Decay 25/26 27/28	Completed decay 25/26, repeat of 15/16 except freq.& Force Dist. 27/28	Freq. 12.3 Hz Freq. 11.9 Hz

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
	11/13/74		**TRK TRN GVS (Sys Test)** Moved truck into south position moved force multipliers to clear truck. Set up in preparation for "Car Full on Trucks" configuration. Repositioned V4 & V4A to clear hoppers when car is lowered on trucks.	
	11/14/74		Finished installing trucks under car. Modified force multipliers for clearance. Reduced decay data to permanent records. Taped checked All inst. and checked noise levels. Loaded CO/QUAD program into computer.	
0905	11/15/75	35 WB	Shakers V1, V3, V5, V7 = $0^{o}\phi$ Freq. 2-50 Hz Force Ref. F3 $\approx$ 30 lb-pk, 200mvrms @ 10 Hz All other forces same Completed Run 35 WB	Monitored AV9/F3 w/friction shoes
0915		36 WB	Shakers V1, V3 = $0^{o}\phi$, V5 V7 - $180^{o}\phi$ Freq. 2-50 Hz Force Ref. F3 $\approx$ 30 lb-pk, 200 mvrms @ 10 Hz All other forces same Completed run 36 WB	Monitored AV9/F3 w/friction shoes
0930		37 WB	Completed Run 37 WB, repeat of 36 WB except as noted *	*Monitored AV12/F3 w/friction shoes
0945		38 WB	Completed Run 38 WB, repeat of 35 WB except as noted *	*Monitored AV12/F3 w/friction shoes

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
	11/15/74	Mode 1 Dwell 1	**TRK TRN GVS SYS TEST** Tuned 1st vertical truck mode @ 6.31 Hz Shakers: V1, V3, V5, V7 = $0^{o}\phi$ Force Ref. F3=$0^{o}\phi$ F1=$0^{o}\phi$ F5=$0^{o}\phi$ F7=$0^{o}\phi$ 134 mv 130 mv 136 mv 136 mv	Monitored AV12/F3 w/friction shoes
1020			Completed Mode/Dwell	
1055			Tuned 2nd vertical truck mode @ 9.26 Hz Disabled friction shoes between side frame and bolster, completed north end of car.	Monitored AV9/F3 w/friction shoes
1500				
	11/18/74		Continued friction shoe pin installation Put RMS meter in for calibration Gave charge Amps to AVL for mortar fire test completion.	
	11/21/74	39 WB	Installed charge amps, set sensitivities Checked noise levels Shakers V1, V3, V5, V7 = $0^{o}\phi$ Freq. 2-50 Hz Force Ref. F3 $\approx$ 30 lb-pk, 200 mvrms @ 10 Hz All other forces same	Monitored AV12/F3 w/o friction shoes Lost shaker fans Force signals were distorted
1430			Completed Run 39 WB	
0812	11/22/74	40 WB	Completed run 40 WB, repeat of 39 WB Freq. 1-50 Hz	Monitored AV12/F3
0829		41 WB	Completed run 41 WB, repeat of 36 WB except as noted *	Monitored AV9/F3 *Freq. 1-50 Hz V5 & 7 = $180^{o}\phi$ V1 & 3 = $0^{o}\phi$

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
0940	11/22/74	Mode 1 Dwell 1	**TRK TRN GVS (SYSTEMS TEST)** Tuned 1st vertical rigid body truck mode @ 2.126 Hz Shakers: V1, V3, V5, V7 = 0°ϕ Force Ref. mvrms: F3/11 (underlined), F1/22.5, F5/12.5, F7/6.5	Monitored/Av12/F3 F3 = 200 mvrms @ 10 Hz
1036		Mode 2 Dwell 2	Tuned 1st vertical rigid body pitch truck mode @ 2.85 Hz Shakers: V1, V3 = 0°ϕ , V5, V7 = 180°ϕ Force Ref. mvrms: F3/10 (underlined), F1/15, F5/14, F7/15	Monitored Av9/F3 F3 = 200 mvrms @ 10 Hz
1315		Mode 3 Dwell 3	Tuned 1st vertical bending mode @ 12.79 Hz Shakers: V1, V3, V5, V7 = 0°ϕ , V4, V4A = 180°ϕ Force Ref. mvrms: F4/195, F1/100, F4A/183, F3/96 (boxed), F5/80, F7/70	Monitored Av12/F3 F3 = 200 mvrms @ 10 Hz
1505		Mode 4 Dwell 4	Tuned 1st vertical bending mode @ 14.96 Hz Shakers: V1, V3, V5, V7 = 0°ϕ , V4 = 180°ϕ Force Ref. mvrms: F3/200 (underlined), F1/128, F4/204, F5/132, F7/104	Monitored Av12/F3 Lost shaker fan F4A

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1527	11/22/74	Mode 5 Dwell 5	TRK TRN GVS (SYS TEST) Tuned 2nd vertical bending mode @ 17.45 Hz Shakers: V1, V3 = 0°φ , V5, V7 = 180°φ Force Ref. F3 F1 F5 F7 mvrms	Monitored AV9/F3
0905	11/25/74	Mode 5 Dwell 5	Tuned 2nd Vertical bending Mode @ 17.9 Hz Shakers: V1, V3 = 0°φ , V5, V7 = 180°φ Force Ref. F3 F1 F5 F7 mvrms 63 67 62 67	Monitored AV9/F3
0935		Mode 6 Dwell 6	Tuned 2nd vertical bending mode @ 19.5 Hz Shakers: V1, V3 = 0°φ , V5, V7 = 180°φ Force Ref. F3 F1 F5 F7 mvrms 63 48 49 45	Monitored AV9/F3
		Decay 29 30	Freq 19.5 Hz Shakers: V1, V3 = 0°φ , V5, V7 = 180°φ Recorded: AV1, AV8, AV9, AV12, AV17 & A24 F3 & OSC	Monitored AV9/F3
1105 1315		Decay 31/32 33/34 35/36 37/38 39/40	Freq. 17.9 Hz Freq. 14.96 Hz Freq. 12.79 Hz Freq. 2.85 Hz Freq. 2.126 Hz Set all force dist. and φ in accordance with modes 1-6 resp.	14.96 Hz beating

E54

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1355	11/25/74	42 WB	TRK TRN GVS (SYS TEST) Shakers V1, V7 = $0^{o}\phi$, V3, V5 = $180^{o}\phi$ Force Ref: F3 = 200 mvrms @ 10 Hz	Monitored AV17/F3
1405		43 WB	Shakers V1, V5 = $0^{o}\phi$, V3, V7 = $180^{o}\phi$ Force Ref: F3 = 200 mvrms @ 10 Hz	Monitored AV 17/F3
1500		Mode 7 Dwell 7	Tuned 1st rigid body torsional mode @ 3.15 Hz Shakers: V1, V7 = $0^{o}\phi$, V3, V5 = $180^{o}\phi$ mvrms F1 80, F3 60, F5 72, F7 90	Monitored AV 17/F3
1505		Decay 41 42	Recorded decays AV1, AV8, AV17 AV24 F3 & OSC @ 3.15 Hz	
1300	11/26/74	Mode 8 Dwell 8	Tuned 1st torsional @ 6.16 Hz Shakers: V1, V5 = $0^{o}\phi$, V3, V7 = $180^{o}\phi$ mvrms F1 56, F3 21, F5 10, F7 32	Monitored AV17/F3 Forces distorted Evaluated drift problem
1355		Mode 8 Dwell 8	Returned mode 8 with high force input @ 6.3 Hz Shakers: V1, V5 = $0^{o}\phi$, V3, V7 = $180^{o}\phi$ mvrms F1 98, F3 96, F5 88, F7 86	Monitored AV17/F3 Rel. motion between car & bolster

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1415	11/26/74	Decay 43	**TRK TRN GVS (SYS TEST)** Record decays AV1, AV8, AV17, AV24, AL1 F3, OSC @ 6.3 Hz	Monitored AV17/F3
1420		Decay 45 46	Recorded decays AV1, AV8, AV17, AV24, AL1 F3, OSC @ 6.16 Hz	Monitored AV17/F3
1503		Mode 9 Dwell 9	Tuned 3rd torsional mode @ 14.48 Hz Shakers: V1, V7 = $0^{o}\phi$, V3, V5 = $180^{o}\phi$ mvrms F1/78 F3/79 F5/80 F7/81	Monitored AV17/F3
1515		Decay 47 48	Recorded decays AV1, AV8, AV17, AV24, AL1, AL9 F3, OSC @ 14.48 Hz	Monitored AV17/F3
0820	11/27/74	Mode 10 Dwell 10	Tuned 2nd torsional mode @ 9.0 Hz Shakers: V1, V7 = $0^{o}\phi$, V3, V5 = $180^{o}\phi$ mvrms F1/134 F3/126 F5/125 F7/126	Monitored AV17/F3
0826		Decay 49 50	Recorded decays AV1, AV8, AV17, AV24, AL1, AL8 F3 & OSC @ 9.0 Hz	Monitored AV17/F3
0917		Mode 11 Dwell 11	Tuned ? 6th torsional mode @ 18.7 Hz Shakers: V1, V7 = $0^{o}\phi$, V3, V5 = $180^{o}\phi$ mvrms F1/38 F3/27 F5/25 F7/54	Monitored AV17/F3 AL4, AL16 Decays
0928		Decay 51 52	Recorded decays AV1, AV8, AV17, AV24, AL4 AL16 F3 & OSC @ 18.7 Hz	Monitored AV17/F3
1020		Mode 12 Dwell 12	Tuned 1st diagonal mode @ 12.56 Hz Shakers: V3 & V7 = $180^{o}\phi$ mvrms F3/114 F7/109	Monitored AV17/F3 Decay AL1, AL16

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1024	11/27/74	Decay 53 54	**TRK TRN GVS (SYS TEST)** Recorded decays AV1, AV8, AV17, AV24, AL1, AL16 F3 & OSC @ 12.56 Hz	Monitored AV17/F3
1050		Mode 13 Dwell 13	Tuned 2nd diagonal mode @ 13 Hz Shakers: V1 & V5 = $0^{o}\phi$ mvrms F1 109, F5 76	Monitored AV1/F1 Decays AL1, AL16
1055		Decay 55 56	Recorded decays AV1, AV8, AV17, AV24, AL1 AL16, F1 & OSC @ 13.0 Hz	Monitored AV1/F1
1325		Mode 14 Dwell 14	Tuned ? torsional mode @ 16.44 Hz Shakers: V1, V5 = $0^{o}\phi$, V3, V7 = $180^{o}\phi$ mvrms F1 95, F3 104, F5 99, F7 75	Monitored AV17/F3
1330		Decay 57 58	Recorded decays AV1, AV8, AV17, AV24, AL1 AL16, F3 & OSC @ 16.44 Hz	Monitored AV17/F3
1425		Mode 15 Dwell 15	Tuned ? Torsional mode @ 20.4 Hz Shakers: V1, V5 = $0^{o}\phi$, V3, V7 = $180^{o}\phi$ mvrms F1 37.5, F3 22.5, F5 24, F7 17.5	Monitored AV17/F3
1430		Decay 59 60	Recorded decays AV1, AV8, AV17, AV24 AL8, AL12, F3 & OSC @ 20.4 Hz	Monitored AV17/F3

TABLE 8.4 TEST HISTORICAL LOG

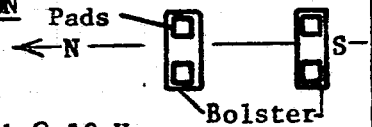
TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
1305	12/2/74	44 WB	ROLL STOP EVALUATION Installed roll stop blocks  Shakers: V1, V3, V5, & V7 = $0^{o}\phi$ Force Ref. F3 = 200 mvrms ≈ 30 lb-pk @ 10 Hz Freq 1-50 Hz	Monitored AV12/F3 All other shakers equal to F3 force ref.
1320		45 WB	Shakers: V1, V3 = $0^{o}\phi$, V5, V7 = $180^{o}\phi$ Force Ref F3 = 200 mvrms ≈ 30 lb-pk @ 10 Hz Freq 1-50 Hz Took movies	Monitored AV9/F3 All other shakers equal to F3 force ref
1400		46 WB	Shakers: V1, V7 = $0^{o}\phi$, V3, V5 = $180^{o}\phi$ Force Ref F3 et al. = 200 mvrms ≈ 30 lb-pk @ 10 Hz Freq 1-50 Hz Took movies	Monitored AV17/F3
1425		47 WB	Shakers: V1, V5 = $0^{o}\phi$, V3, V7 = $180^{o}\phi$ Force Ref F3 et al. = 200 mvrms ≈ 30 lb-pk @ 10 Hz Freq 1-50 Hz	Monitored AV17/F3
1450		48 WB	Repeat of 45 WB	Monitored AV9/F3
0945	12/3/74	49 WB	Removed steel roll stop blocks & installed wooden wedges Shakers: V1, V3, V5 & V7 = $0^{o}\phi$ Freq. 1-50 Hz Force Ref F3 et al. = 200 mvrms @ 10 Hz	Monitored AV12/F3
1000		50 WB	Shakers V1, V3 = $0^{o}\phi$, V5, V7 = $180^{o}\phi$ Freq 1-50 Hz Force Ref F3 et al. = 200 mvrms @ 10 Hz	Monitored AV9/F3
1015		51 WB	Shakers V1, V7 = $0^{o}\phi$, V3, V5 = $180^{o}\phi$ Freq 1-50 Hz Force Ref: F3 et al. = 200 mvrms @ 10 Hz	Monitored AV17/F3

TABLE 8.4 TEST HISTORICAL LOG

TIME	DATE	RUN NO.	TEST DESCRIPTION	REMARKS
	12/3/74		ROLL STOP EVALUATION	
1025		52 WB	Shakers V1, V5 = $0^{o}\phi$, V3, V7 = $180^{o}\phi$ Freq 1-50 Hz Force Ref: F3 et al. = 200 mvrms @ 10 Hz	Monitored AV17/F3
1045		53 WB	Removed blocks on east side Repeat of 52 WB	Monitored AV17/F3
1100		54 WB	Repeat of 51 WB	Monitored AV17/F3
1210		55 WB	Repeat of 50 WB	Monitored AV9/F3
1225		56 WB	Repeat of 49 WB Removed remaining wood blocks	Monitored AV12/F3
	12/10/74		Completed Data Reduction- Decay Data	
	1/2/75		Completed Data Reduction- Mode Shape Plots	